ERIC Research Report

An EXPERIMENTAL STUDY TO ASSESS THE EFFECTIVENESS OF ADAPTED INSTRUCTIONAL MATERIAL IN SCIENCE ON HEARING IMPAIRED FROM IED AND SPECIAL SCHOOLS

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1992

PREFACE

The academic integration of hearing impaired particularly those with substantial hearing loss require preparation of both materials and management. The regular teachers are not fully equipped to undertake the responsibilities of educating the hearing impaired who are enrolled directly in inclusive system of education. This difficulty has been realised more by science teachers as they found themselves handicap in making these children understand the difficult concepts of science used in the text books. The educational technology needed here for teaching such difficult concepts and meaning is nothing but suggesting adaptations and simplifications of content and methodology. The simplification of content and methodology here means only making use of multisensory approach and substitution of the academic activities which ensures the disabled child in getting equal learning experience in IED settings. To help the teachers it was visualized that the development of the handbook on adaptation for teaching science to hearing impaired studying in classes I-VII will be useful and will help them to participate in science classes in IED without much difficulty. This also will facilitate them, in getting retained into to continue in the educational system without any stagnation. The handbook for teachers teaching science for classes I-VII was developed and tried out to know its effectiveness. The results obtained are very encouraging

that the use of adapted instructional material in science could help in raising the science achievement of hearing impaired from both IED and special settings. Even the hearing poor achievers were also got benefitted by this material. This report gives more details about the effectiveness of the adapted instructional materials developed in science.

The report has four chapters namely Introduction, Review of Related Literature, Test and Method and Result and Discussions. The first chapter, provides details regarding science teaching, difficulties faced in science teaching, Concept formation and need for better science teaching to hearing imapired. In the second chapter, the Review of Related Literature has been given. The third chapter deals with the experimental material guidelines and details of the tests used for the study. In the last chapter, Results and Discussions have been given.

The main findings of the study are: The hearing impaired studying in IED and special schools have shown improvement in science achievement after the use of adapted instructional material. The performance of hearing impaired from classes V, VI and VII from IED is significantly higher than students of the special schools but the hearing impaired studying in special schools in lower grades (classes I to IV) have done better than their counterparts from IED. The age, sex and

medium of instruction (English, Hindi and Kannada) are not found to be significantly related to science achievement scores.

The findings of this study can help the teachers in developing the instructional and learning materials for teaching difficult content areas and also in developing insight into the problems faced by this group of children in both IED and special schools. It can also be used for better educational planning and management of this group in IED.

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ACKNOWLEDGEMENTS

We are indebted to the ERIC authorities for providing necessary financial and moral support to carry out this project.

We owe our thanks to the authorities of NCERT and RCE, Mysore for providing opportunity to do this work and for providing all administrative support to complete this project.

Our thanks are due to the heads of 8 schools (IED and special schools) for rendering their help and co-operation for completing data collection. We are specially thankful to students of classes I-VII for their sincere co-operation for completing the tests in two sessions; Without their co-operation it would not have been possible for us to write this report.

We are grateful to Mr. B.D. Jairam from CIIL, Mysore for helping us in statistical analysis of the data. We owe our gratitude to the NCERT and RCE faculty members who provided

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help at various levels. It would be difficult to single out their influence and help at this juncture.

We are grateful to the administrative staff of RCE, Mysore for their necessary help.

Last but not the least our thanks are due to the Dynol Computer Centre for doing this work so efficiently.

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CHAPTER I

1.0. INTRODUCTION

1.1. Context

The need for inclusive education for the handicap children in the existing regular schools, has been realised by the policy makers as well as by the educationists in country, concerned over the problem of compulsory primary education for all. The sizeable population of the handicapped children in the age group of Universal Primary Education (UPE) is not able to attend minimum educational facilities due to the limited number of Special Schools in the country. Besides segregated education may have severe implication for their educational development as well as for their social and emotional developments. It is therefore needed to explore various components related to the curricular requirements and teaching competencies to educate these children in our regular schools. This study has attempted to explore the position of learning Science by the hearing impaired studying in IED and Special Schools of Delhi, Gurgoan (Haryana) and Mysore, since Science and Mathematics are considered to be difficult subjects and are not offered after VII standard in Special Schools. The investigator wished to know the difficulties involved in learning Science concepts by hearing impaired studying in classes I to VII in Integrated Settings and Special Schools.

*A handbook on adaptation for teaching complex concepts and difficult meanings identified from the text books of the concerned grade, with the consultation of Science teachers teaching Science in IED and Special Schools was developed and tried out. It was done to know whether there is any difference in learning styles of hearing impaired and hearing children. The various research studies conducted in this area have reported that hearing impairment has serious implications for learning complex concepts. They also reported that hearing impairment affects perception and learning of language symbols which act as facilitating factors for concept development. Since science learning is related to the level of intelligence and perception of the child therefore this area requires greater attention from the point of integrated education. Through Science the child's curiosity to explore the environment with greater understanding is possible and it may also help in developing scientific temper in the children in the beginning stages of his/her education. Even in Kothari Commission (1964-66) stress has been given for a proper understanding of the basic principles and processes of scientific abstractions and creative thinking. The development of efficient Science education at the earliest stage is a pre-requisite for establishing a sound foundation

*For more information refer Handbook on Adaptation in Science

for the later study of the discipline. During the primary school stage children are at the formative stage. Therefore, study of the discipline. During the primary school stage children are at the formative stage. Therefore, the impressions they get in the form of learning at this stage is of utmost importance. If the experience and learning is beneficial and effective at this stage it will last longer and it lays a sound basis for further learning and success. Therefore top priority should be given to develop scientific temper among the students.

In recent years Indian Scientists have achieved good progress in the field of space research. Thus Science and its achievement has become the talk of every person. This naturally implies that our schools should provide meaningful Science education. Science has been considered as an essential ingredient of one's personality in the modern age. In recent years, there has been a general comment from the public and from the parents that our schools are not providing Science education of the desired standard. This comment cannot be just brushed aside rather this should be taken in the right spirit and we should probe into the causes for this.

The poor performance of our students especially in Science subjects needs to be thoroughly investigated. There are many factors which influence learning Science. The poor

performance may be due to poor teaching, lack of motivation, lack of laboratory facilities, stereo typed curriculum, one's family background, adverse socio-economic conditions, lack of parents' care and may be sensory deficits. Therefore, there is need to adapt the curriculum to meet with their special needs to facilitate for better academic integration.

The adaption in Science curriculum does not mean dilution or compromise, rather it means better curricular activities, appropriate methodology and materials. Therefore, while adapting Science curriculum to the needs of hearing impaired, original concepts should neither be diluted nor distorted. The concepts which are particularly difficult for hearing impaired, for example teaching concept of sound and its properties to the hearing impaired in regular class such concepts need to be developed with the help of additional visual, tactual and kinesthetic cues. The supplementary visual/tactual inputs will help the hearing impaired in learning the Science concepts in a better way even in integrated settings.

An understanding of the process of concept attainment in these students will be of great help to teachers and curriculum planners of IED. Every regular teacher needs mastery over the techniques to help these students in the inclusive system of education. An understanding of the process of concept attainment among hearing impaired would

enable the curriculum planners to venture the introduction of some of the key fundamental concepts at an earlier stage. Learning is represented by a process leading to the exclusive use of the correct hypothesis. Such learning logically involves developing the appropriate stimulus descriptions, generating a set of hypothesis and applying these hypothesis to the stimulus description in an appropriate way.

1.2. Concept Development

The term 'concept' has a multitude of meanings. Most of us have used or applied it in a myriad of ways, and among these uses there may not be a great deal of obvious similarity. For example, 'Concept' is commonly used as a synonym for idea, as when we say "Now he seems to have the concept", in reference to someone who has finally caught onto a message. On other occasions, a concept seems to be akin to a mental image, as in the case of trying to conceptualize (visualize) an unfamiliar object or event from a verbal description. Each of us carry around a fairly large number of concepts. Most of them we have learned at some earlier time and use in everyday behaviour, but we do continue to learn new concepts when the occasion demands. If an individual were to utilize his full capacity for distinguishing between things and were to respond to each event as unique, he would shortly be overcome by the complexity and unpredictability of his environment. Categorizing is not only an easy way but also a necessary way

of dealing with the tremendous diversity one encounters in everyday life. Concepts code things into a smaller number of categories and thus simplify the environment to some degree.

A concept is a grouping of relationships, of likeness which explains objects and events in the world about us. A concept is new only to scientists, or to us, or to the children. The teachers art lies precisely in the creating of situations through which children uncover concepts. This appears to be a plain and clear prescription, but of course there are some extremely complex problems confronting the teacher. Among individuals sensory perception varies and because human experiences vary in both kind and number, no two children begin school with the same knowledge, or with the same set of experiences. It cannot be presumed, therefore, that within the school framework they will move with equal speed or along precisely similar lines of growth. Some kind of provision has to be made to accommodate children of varying experience and of varying ability, and that provision is not alone concerned with the broader questions of homogeneous grouping in schools or of an ungraded curriculum, it is also concerned with providing a scientifically sound structure of learning and teaching Science that enables children to uncover the concepts of science in an orderly way and at a pace of their individual competency. A concept is a mental construct, it is a grouping of the common elements or attributes shared

by certain objects and events. Qnce a concept is attained, economy in future learning is also attained. In other words a concept is a network of inferences stemming from observation of objects and events, resulting in the selection of common elements, or like attributes, among the objects and events under observation. A concept is practical and useful because the perception of a small number of attributes, cues or signals bring the whole object or event into satisfying recognition.

In order to have a concept we must first be acquainted with a word. Doubtless this is usually the case, but it is not always the case. A person may have something in mind for which no word yet exists and he may then invent a word or expression for it, or he may use an old word or sign in a new sense giving it a meaning it never had before. In either case, it seems plausible to say that he had the concept prior to the existence of the word. Using a word correctly seems to be a consequence of having the concept and know the word for it, we will then be able to use the word correctly, but having concept is not the same thing as being able to use the word.

Since hearing impaired on receptive understanding are found to be equal to hearing children therefore this part is needed to be confirmed to this context.

A child may have a concept of 'x' even though there are no 'x's' in the world at all; or a concept of a thing that is a reptile, larger than an elephant and flies through the air, or about a creature which may be existing or not be existing. Even the concept can be formed without giving any image. Scientists have a concept of ultraviolet without being able to visualize ultraviolet, surely a blind child can have a concept of red without being able to visualize red. But, we can now say, the blind child though he has a criterion for distinguishing 'x' from 'non-x', does not have the same concept as a sighted child has. For doing this the blind child does not have the same criterion for distinguishing red from non-red rather he must see wave-lengths as his criterion.

Do concepts based on experience - which means that in the case of simple 'ideas' a concept of 'x' is impossible without a prior experience of 'x' and in the case of 'Complex ideas' the concept of 'x' is impossible without a prior experience of the simple ideas of which it is constituted? The view seems not only plausible but inevitable, for what is the alternative? We are not born with concepts, nor do we remember them from a state of existence prior to our birth; so how else could we acquire them except through experience? The relation between concept and sense - experience is very indirect; there is no particular sense-experience or even any single kind of sense - experience, that we must have had before we can have this

concept. Whatever the connection is between the concept and experience, it is sufficiently indirect that no one has given a clear account of exactly what this connection is in every case.

1.3. Concept Development in Hearing Impaired Children

The concept development takes place through knowledge, experience and intelligence. The process of concept learning has three important phases viz., perception, abstraction and generalization (Lovell, 1961). Hearing is an important sensory mechanism through which an individual acquires knowledge about the environment. Concept development takes place in the normal hearing child at a time when he is aquiring many other skills and knowledge about the world through the physical and social interaction with the environment. Loss of hearing results in an impoverished information about the environment and restricts the interaction with the environment by interfering with the acquisition of normal speech. The normal hearing child acquires the concepts through first hand experience, activity and spoken vocabulary. Without words young hearing impaired children tend to have vague and incorrect notions. Ideas and concepts are clarified when expressed in simple language that the young child can understand and use. The young hearing impaired child is curious about his environment and the experience he has. He tries to reason about them. Without words as his tools he

cannot ask questions, and the discovery of relationships remain unexpressed. Thus his reasoning powers may become stunted (Agnes H. Ling, 1978). Normal development with regard to concept formation depends upon the abilities to differentiate, abstract, generalise and categorize. These abilities depend upon intelligence and memory. Pintner the father of psychology of deafness has stated that the general intellectual level of deaf children is below that of normal hearing children. This fact that the hearing handicapped are retarded in their intellectual functions, was later supported by Oleonon, 1950; Goetzinger et al., 1967. It was stated that the deaf individuals used different coping mechanisms to perform cognitive tasks and that the abstract thinking component of their intellectual structure appears later than that of their hearing peers (Zweibel, Abraham Merters, Donnati, 1985). The performance of the hearing impaired children was lower than that of the normal children on an intelligence test (R. Dharitri and Vinoda Murthy, 1989). The study on Indian Children conducted by the author in (1989) showed that the performance of the deaf was lower in the verbal intelligence test and was equal on the nonverbal intelligence test, in comparison to the normal peers of the same age group. This difference in intelligence among the hearing impaired children is attributed to the arrested development of cerebral function due to the early deprivation of auditory stimuli. It was found by Tsui, Hing Fung and

others (1989) that the working memory capacity of the deaf subjects was depressed. These studies support the view, that the hearing impaired children lag behind in concept development than their normal hearing peers. There are enough studies to confirm that hearing impaired children have difficulty in learning the basic concepts. Oleron, McAndrew and Hofler (1953) noted that the deaf subjects had difficulty subordinating observed or perceptive characteristics to concepts. Hughes (1961) found that intellectually average deaf performed better at the percept level than at the concept level. Devis, Julia (1974) found that the respones on Boehm Test of basic concepts by 6-8 years age group of the hearing impaired children, indicated poorest performance on time concepts, followed by quantity, miscellaneous and space concepts in an order. Furth (1964, 66) reasoned that the delay in cognitive development of deaf children is due to a restricted environment rather than intellectual or linguistic deficiency. So hearing impairment leads to retarded concept development as it affects perception and learning of language symbols which act as facilitating factors of thinking as well as acquisition and utilization of knowledge. He also realised that one of the formidable barriers to assessing cognitive development in hearing impaired children was the ability of the examiner to communicate the critical dimensions of the tasks and to provide the hearing impaired child with a means of responding that did not penalize him for his language or speech ability.

1.4.0. The Present Study

The study attempted to explore the science concept attainment by hearing impaired with the help of adapted instructional material prepared for the science teacher for teaching hearing impaired in IED and Special Schools. The adaptions in content and methodology were done with the consultation of teachers teaching science to them. The identified difficult concept and words were listed and teaching guidelines were given to help the teachers to provide more visual and simple feedbacks by involving the hearing children and hearing impaired, using more charts and black board writing, to provide concrete situations. The handbook prepared on adaptations in content and methodology. was given to each science teacher and these teachers were given orientation how to use the book. This material was tried in IED and special school of Delhi, Haryana and Mysore. The findings are quite encouraging since, it was reported by teachers that the adaptations helped the hearing impaired and also hearing children in getting good grades in science and could lead to better clarity over the difficult concepts. The findings will be discussed in the 4th chapter of this report.

1.4.1. The Objectives of this Study were

- To facilitate the teachers of hearing impaired teaching science to the classes I-VII for raising their level of class-room participation.

- To help the teachers of IED schools in developing needed sights for devising better teaching methodologies for IED classes.
- To help the hearing impaired studying both in IED and Special Schools from classes I-VII in learning science concepts better.
- To facilitate the teacher to teach the difficult concepts by involving other sensory channels for providing same learning experience in IED class.
- To provide compensatory inputs to both the hearing impaired and hearing children for understanding the taught concept clearly.

1.4.2. Hypothesis of the Study

It was assumed that:

- The younger group of hearing impaired will do better than the older students on science achievement tests.
- The girls will be performing better than boys.
- The hearing impaired studying in inclusive system of education will do better than those who are studying in exclusive system of education.
- Students studying through mother tongue/regional language medium will to better than those who are studying through English medium.

1.4.3. Sample Size

The sample comprised of 327 students from classes I-VII drawn from 8 different schools (both IED and Special Schools) of Delhi, Haryana and Mysore. Out of 327 students, 90 students were hearing children and remaining 237 were hearing impaired children. Out of 90 hearing children 45 were females and 45 were males. Out of 237 hearing impaired children, 69 were females and 168 were males. The number of students both hearing and hearing impaired males and females vary from class to class and school to school because of the criteria adopted for selection of the sample.

The list of schools are as follows:

- Balvantray Rai Mehta Vidya Bhawan, IED School, Delhi.
- Government Lady Noyce Higher Primary School for the Deaf, Delhi, Special School.
- Society for Speech and Hearing Handicapped Deaf and Dumb School Gurgoan, Haryana State, Special School.

The remaining 5 schools were selected from Karnataka State. Out of 5 schools, 4 were integrated schools and one was a special school for hearing impaired.

- Government Deaf and Dumb School, Mysore. (Special School)
- D.M.S. RCE, Mysore. (IED School)
- Rotary English School, Mysore. (IED School)
- Jyothi Convent, Mysore. (IED School)
- Government Higher Primary School, Mysore. (IED School)

The students drawn from each school are as follows:

- 40 (15 females and 25 males) hearing impaired from IED School, Delhi.
- 59 (29 females and 30 males) hearing impaired children from Special School, Delhi.
- 57 (22 females and 35 males) hearing impaired children from Special School, Gurgoan Haryana.
- 78 (all males) hearing impaired children from Special School Mysore.
- '81 (40 females and 41 males) hearing children from IED School, Mysore.
- 2 females and 1 male hearing child and one female hearing impaired child from IED School, Mysore.
- 1 male and 1 female hearing impaired child and one male hearing child from IED School, Mysore.
- 2 female and 1 male hearing impaired children and 2 female and one hearing children from IED School, Mysore.

1.4.4. Tools Used

The hand book on adaptation in Science instructional material was given to the teachers of hearing impaired for teaching Science in IED and Special Schools'. This handbook was prepared by the help of teachers teaching Science in both IED and Special Schools. Science achievement tests were developed to assess the effectiveness of the adapted material used for teaching science. These tests were conducted twice on the selected sample to assess the effectiveness of material.

CHAPTER II

2.0. REVIEW OF RELATED LITERATURE ON HEARING IMPAIRMENT

2.1. Context

Hearing impairment leads to serious educational handicap as it affects perception and learning of languages. The symbols which act as facilitating factors for thinking, acquisition and utilization of knowledge. Though, the hearing impaired children have reported to pass through same stages of growth and development still when compared to normal children's development hearing impaired are comparatively slower. The steps taken towards providing suitable instructional and learning materials to the hearing impaired children for their better academic integration in India are hardly few. The integrated education helps these children to learn the same curriculum which is offered to normal children in regular schools. The study undertaken by the Indian scholars are limited to the exploration of parental attitude, teachers attitude, language and speech problems and a very few studies have attempted to explore their competence levels in various areas of learning. The findings of most of these studies largely suggest that the hearing impaired are linguistically behind to the hearing children, with the result they find difficult to participate in regular schools. A few of these studies suggest that particularly the hearing impaired children have normal intelligence and they have the

potentiality to go for normal education. Hence, it is envisaged that they will follow the same stages in concept development. The studies also reported that there is a positive correlation between level of intelligence and concept development, which means that those hearing impaired who have normal intelligence will be able to develop the concept like normal children. Therefore, there is a need to explore this area.

2.2. Science Teaching

Science is one of the most fundamental learning areas of the school curriculum as it helps the children to be more curious and imaginative in the understanding of their immediate environment. In the elementary stage of education especially science as a curricular subject, occupies an even more important place because it is at this stage that the foundation is laid for the proper development of scientific temper and inquiry. Since, it is an important subject for the students to know it should be introduced as early as possible for both the hearing and the hearing impaired to achieve the main objective of integrated education. The scientific temper should be developed at earlier stages as at later stages students may not be in a position to use their imagination and inquiry method as freely as they can do at earlier stages of education. The continuous exposure of students to the scientific things may facilitate deeper and more intuitive understanding of the subject.

Learning is represented by a process leading to the exclusive use of the correct hypothesis. Such learning logically involves developing the appropriate stimulus descriptions, generating a set of hypothesis and applying these hypothesis to stimulus description in an appropriate way. A concept is not an absolutely fixed and static entity. It is usually a growing, changing mental structure.

The hearing impaired population has often served as a 'laboratory' group to test the dependence or independence of cognition and language. Much of the research on cognitive development has followed a Piagetian's model. Researchers have compared the performance of the hearing and the hearing impaired children on several Piagetian tasks and have drawn conclusions about the relationship between language and cognition.

Early researchers such as Oleron and Herren (reported in Furth, 1966) examined the performance of the hearing impaired children on Piagetian conservation tasks to determine whether cognitive growth could take place in the 'absence' of language. They found that the hearing impaired individuals reached the level of concrete operations 6 years later than the hearing children and concluded that language was not a condition for cognitive development. But, some others reported that linguistic deficiency could retard cognitive development of the hearing impaired children (Sharma, 1989).

The cognitive development in the hearing impaired children stems from the work of Hans Furth (1966) who hypothesized that any delay in cognitive development was due to experiential deprivation. Furth (1966) conducted a series of research studies examining the performance of the hearing impaired children on various Piagetian tasks (Furth, 1964, 1966 a). He realized that one of the formidable barriers to assessing cognitive development in the hearing impaired children was the ability of the examiner to communicate the critical dimensions of the tasks and to provide the hearing impaired child with a means of responding that did not penalize the hearing impaired for his/her language or speech ability. Furth (1966) reasoned that the delay in cognitive development of the deaf children was due to a restricted environment rather than intellectual or linguistic deficiency. The hypothesis of experiential deficiency was supported by Darbyshire and Reeves (1969), who found no significant difference between the hearing and the hearing impaired children on the attainment of concepts at the pre-operational and concrete operational levels. In this study, socio-economic background rather than hearing loss proved to be the variable that contributed significantly to difference in performance.

Watts (1988) attempted to determine the effect of linguistic deficiency on cognitive development by comparing groups of the hearing impaired children varying in degree of hearing loss. He compared the performance of the deaf, hard of hearing, and the hearing children on conservation tasks, spatial thinking and social thinking. The hard of hearing children have less severe hearing loss than the deaf children and generally reach higher levels of achievement and communication ability (Jensema, 1975). Thus superiority of the hard of hearing children over the deaf children might reflect the contribution of language to cognitive development.

According to Piaget (1963), the foundation of cognitive development are laid during the sensori-motor stage, in which the child is able to explore and act upon his physical environment. Early preschool environment for the young hearing impaired children tend to stress formal language training over sensori-motor exploration. Thus, the hearing impaired child may in fact be deprived of physical experience that lay the base for later development of logical concepts.

According to Prof. P.N. Dave (NCERT Report), the Indian teachers have been constantly facing some of these problems which are as follows; what content should be choosen? How should the teacher organize a particular content? Are there any specific, concrete activities and aids which can promote

better learning? Are there some standard means and ways o dealing with children, which may be learnt through rigorou training? If the goal is the achievement of the learner, the educational research has to find out answers to these problem in terms of certain factors, viz., intelligence, study habits attitudes of pupils towards school, different aspects of thei personality, socio-economic status etc., age, sex, medium o distruction which directly or indirectly influence academi achievement. For a better curricular development these ar the areas which deserve to be X-rayed through prope educational research and suitable instructional and learnin materials need to be provided for better academic achievement of the students. Since, the need for suitable material fc teaching as well as for learning has been emphasised so thi study has made some attempt in this regard.

This study attempted to explore the impact of adapte instructional material, developed to teach Science concep and meaning to the hearing impaired studying in integrat education programme and special schools to know t possibility integrating these children in the existi educational facilities.

Since inclusive education is the latest trend in t education of the hearing impaired a very few research studi have been done in this area. However, the investigator h

attempted to categorize the findings of various research studies influencing concept development at an elementary level. The review of the literature given below help in gaining some insight into the problems faced by the hearing impaired in learning Science in IED and Special schools and also to understand the importance of language factors in attaining the concepts of Science. The review of various studies given below have been categorised as follows:-

(i) Studies related to Science concept development among the hearing impaired children.

(ii) Studies related to the teaching strategies of Science for the hearing impaired children.

(iii) Studies related to the variables affecting concept development among the hearing impaired children.

(iv) Studies related to the various components of language like Comprehension, Vocabulary and Reading.

2.3. Studies Related to Science Concept Development Among the Hearing Impaired Children

Research findings suggested that the abstract mental processes were more difficult for the deaf than for the normal hearing (Doctor, 1950). Templin found that the defective hearing subjects became increasingly poorer than the normal at higher abstract level. Hughes (1961) found that the intellectually average deaf performed better at the percept level than at the concept level. The educators working in the

area of the hearing impairment suggest that the curriculum planning for the education of these children require adaptation in both method and teaching of content areas. Teaching science at the primary stages should be motivated in such a way that the concept of Science grows in the mind of the student on the basis of the experiences of his daily life.

These studies are supported by some of the latest research work done as follows.

Davis et al. (1978) found that the hearing impaired children's performance on Boehm test of Basic concepts, was the poorest on time concepts followed by quantity, miscellaneous and space concepts in an order.

Watts, M. (1988), investigated the influence of language on the development of quantitative, spatial (horizontality) and social thinking in the deaf children, significant differences between the normal and the hearing impaired groups were only on the conservation tasks. Garretson, M.D., 1976 reported that children using total communication method performed better than did their aural-oral counterparts. According to Wirth (1983), the deficiency in conceptualization among the hearing impaired children after the age of 18 months was due to a disorder of the semantic lexical system. Fodor, (1974) attempted to determine whether the deaf adults could

identify the facial expressions accurately. In general the results indicated that the deaf individuals were neither better nor worse at identifying emotional expression but the deaf subjects did not have the concept of the emotion of 'disgust'. Malone et al. (1984) found that the deaf pupils did not understand the notions of temporal sequence and duration of time intervals, and so were prevented from thinking and planning for the future.

R. Dharitri and Vinoda Murthy (1989) showed that the hearing impaired children were different in their basic perceptual and conceptual abilities involved in visual recognition and identification of familiar objects. The hearing impaired subjects were poor in visual perceptual synthesis, visual integration, planning and organising to associate symbols and in visual memory. Before advocating a particular method of teaching a subject we should remember here that the success of teaching Science consists imparting proper education by the realization of talents, attitudes and interest of the children. The Science curriculum for a beginner should be based on the findings and experiences which we may gather from his surroundings (Stewart et al., 1982; Karplus, R., 1977). Tobin et al. (1990) reported that several correlation studies indicated that science students could be profited when age, cognitive development, I.Q. and academic achievement of the students were kept in view. Some other

studies also reported. The Science students could not profit from the regular teaching because of their states of intellectual development. The fact that intelligence test predicted school grades, could be of little practical and theoretical importance (Tobin et al., 1990; Oliver et al., 1988).

Yager et al. (1984) reported that the students with good Science lab, Science equipment, method of teaching, use of audio visual aids performed better than the other group which lags the facility.

2.4. Studies Related to the Teaching Strategies of Science for the Hearing Impaired Children

Importance should be given to develop new strategies for teaching the hearing impaired to improve their competencies in different areas of learning. It may be said that strategy factors area have a major influence on performance. This view is supported by some of the following studies.

Jonas, Bruce (1984) found that instruction in instrumental enrichment improved the cognitive abilities like performance in spatial relations, abstract analogies, ability to use more than one rule to solve a problem, fostering more systematic approaches to problem solving, accurate reading and following directions and use of appropriate language for

planning and sequencing events in high school deaf student. Eilers, Rebecca E. and others (1987) showed that the young deaf children's performance on simple. detection and discrimination tasks improved with tactual coders.

Martin, David, S. Jonas and Bruce, S. (1987) found that the cognitive instructions comprising of special training and instrumental enrichment produced statistically significant improvement for experimental subjects, in tests measuring logical reasoning, reading comprehension, math concepts and computations. The findings of Witters Churchill, Laurie, J. and Witters Lee (1989) suggested that the hearing impairment had little impact on the development of cognitive concept, that training in scientific reasoning improved performance in the hearing impaired. Implications for instructions included the value of multisensory experiential learning.

Stainback and Stainback (1984) and Gartner and Lipsky (1989) indicated that all children no matter how severe their handicaps, should be served in one consolidated educational system.

As per Sharelson, (1972) better understanding of Science material is associated with bodies of knowledge whose content should be interrelated in such a way so as to make sense to the learner.

S. Sudara Rajan (1979) findings say that it is a well known fact that unless a teacher has complete confidence in his ability to teach a subject he may not have interest in teaching that subject and cannot also teach well. The quality of Science teaching for that matter was the quality of teaching any subject.

2.5. Studies Related to the Variables Influencing Concept Development Among the Hearing Impaired Children

Some of the variables like age, sex, intelligence, degree of hearing impairment, age of onset, socio-economic status, are found to be influencing on concept development among the hearing impaired children. Few studies related to intelligence and socio-economic status are given here.

Jean Piaget and Bruner found that there is a direct correlation between intelligence and concept attainment. Evidence to support a relationship between Piaget's conventional intelligence came from further studies by Tuddenham (1970), Kaufman (1971), and McNally (1971). Herrick, Helen Marie (1980) studied the relationship between nonverbal concept formation and intelligence in a population of male deaf prevocational students. The findings suggested a mean performance intelligence quotient of 100.96. Tsui, Hing Fung and others (1989) found that the ability to encode both spatial and temporal information was related to some degree of reflective thinking in metamemory.

Clark Thomas Cecil (1979) noted that early intervention treatment for the infant hearing impaired improved the receptive and expressive skills of language.

Whitson, Linda Meroe (1986) found that certain parental attitudes and family factors had noteworthy relationships with the achievement of the hearing impaired secondary school students.

A study on the assessment of the education of young children with deafness (1988), reported that the source of 'problems' was attributed to the child or home environment rather than to the interaction between the child and classroom milieu. A research report (1980) on the deaf children's judgement on Piaget's conservation tasks found no significant difference in the performance between the two sexes. Dr. R.S. Yadav (1987) made an attempt to find out intercorrelations among I.Q. age, academic achievement and parental income and his research result proved that I.Q., is a reliable predictor of academic achievement and it is highly associated with the abilities relating to cognitive development. The I.Q., academic achievement and parental income of the subjects were reported to be highly associated with each other.

2.6.0. Studies Related to the Various Components of Language Affecting Concept Development Among the Hearing Impaired Children

Since language is an important factor influencing concept development, the studies on various components of language may provide a base for understanding the problems of the hearing impaired children in developing language skills. The poor language skills accounts for poor concept learning among the hearing impaired children.

2.6.1. Comprehension

There are studies to support the view that deaf children do not comprehend the language materials as well as the normal children.

Loretta Rec Giorcelli (1983) investigated the comprehension of some aspects of figurative language by the deaf subjects. It was found that the hearing subjects in the age group of 8-9 years were definitely better than all the deaf groups on overall performance. It was found that the older deaf subjects in the age group of 14-20 years out performed the younger deaf subjects.

Marianne Katherine Hessettine (1984) found that the hearing ability was a significant variable affecting comprehension whereas age, performance, I.Q. and sex were not

that significant. It was also found that the age at the onset of hearing loss was the contributory factor in the comprehension of written idioms for the hearing impaired students..

Peter Vincent Paul (1984) found that the hearing subjects were better than the deaf subjects on selecting two meanings for the multimeaning words and in the selection of at least one meaning for the same words.

Berchin, Janice (1989) attempted to find out a chain of functional relationship among a method of interaction referred to as mediation, a cognitive function referred to as spontaneous comparative behaviour, the operation of categorization and the reading comprehension tasks of using lexical cohesion and finding the main idea. Results indicated a treatment effect for the subjects for all the dependent variables as well as the acquisition of the operation of categorization. Results suggested a positive level of cognitive modifiability with the population using mediated instruction.

2.6.2. Vocabulary

Vocabulary is acquired through listening to others' speech and through reading of books. Vocabulary acquisition requires the child's comprehending ability and the hearing

ability. Children learn words by hearing them in the context in which they are spoken. In a hearing handicapped child the words, phrases and sentences are not spoken or if so, the vocabulary at their disposal is very much limited.

Duan Christine Dickie (1979) found that there were difference in the receptive language skills among the hearing impaired children using aural/oral or total communication approach. This was measured on the Boehm Tests of Basic concepts. It was found that the sample in the total communication ground performed significantly better than aid their aural/oral counterparts.

Paul (1984) found that vocabulary growth of the deaf population was quantitatively reduced and slower than that of the hearing peers.

Mayberry and Rachel (1987) found that the deaf children recognised more vocabulary is print than in finger spelling.

Chadha, Gitanjali Gulati (1988) found that the normal students scored significantly higher than the deaf, on the vocabulary testing section of a test.

2.6.3. Reading

In a hearing impaired child the rate of reading is slow and laborious as they have poor expressive skills as well the receptive skills.

James Francis Gregory (1981) investigated word grouping in the deaf children's speech and silent reading. Findings indicated significant positive relationship between speech score and answers on phrased passages and between speech score and correct factual questions.

Morrison, Marcia Mary (1982) found a significant relationship between reading achievements and method of teaching reading, the type of school attended, the hearing abilities of parents and uniformity of communication systems for home, classroom and personal use.

Jerry Herbert Houck (1982) investigated the effect of idioms on hearing impaired students' reading comprehension. Findings revealed that the difficulties were encountered by the hearing impaired when idioms were presented out of context while it was not as detrimental when included in the reading comprehension material.

CHAPTER III

3.0. TESTS AND METHOD

3.1. Context

The Science teaching in integrated settings requires modifications in teaching methodology and contents to achieve the objectives of mainstream education for hearing impaired. The degree and nature of adaptation depends upon the type of hearing impaired, integrated and also on their degree of sensory deficits. The partially hearing impaired children need only adaptation in methodology and not in content. They can be helped by providing additional multisensory aids and equipments. But with the severely and profondly hearing impaired, if not trained thoroughly in linguistic skills then they may need adaptation in content also. The attempt in this study has been made to list the concepts and meanings given in this chapter to be taught with adaptations needed to teach hearing impaired in IED settings. For more details (cf Instructional Material Developed by the Author). These concepts and meanings were taught by the teachers and thus this material was tried out on both hearing and hearing impaired children studying in IED and Special Schools. The Science achievement tests developed (given in Appendix-A) were administered on classes I-VII of these *eight schools selected - New Delhi; Haryana State and Mysore, before using

* Name of the Schools has been kept confidential.

the experimental material (adapted instructions). These tests were again administered individually to students after the gap of 4 months the teachers made use of the experimental material while teaching the below listed difficult concepts and meanings of Science.

3.1. AREAS IDENTIFIED FOR ADAPTATIONS FROM I AND II STANDARD TEXT BOOK

3.1.0. The Identified Areas And Concepts From These Text Books Are Listed Below

Areas identified for adaptation	Page No.	Teaching Strategie
3.1.1. CHAPTER I		
1. Around us		Concept
2. Natural things, Man made things		Concept
3. Natural resources		Concept
4. Living and Non living things		Concept
3.1.2. CHAPTER II : PLANTS AND ANIMALS AROUND US		
5. Common and Specific features of animals		Concept
6. Name the common characteristics of animals		Concept
7. Name the common characteristics of birds		Concept
8. Insects		Meaning
3.1.3. CHAPTER III : ANIMALS AND THEIR WAY OF LIFE		
9. Eating habits of animals		Concept
10. Similar and Different		Concept
11. Adapted		Meaning
12. Reproduction in animals		Concept
3.1.4. CHAPTER IV : OUR BODY		
13. Parts of the body		Concept
14. Tooth-decay		Concept
15. Functions of sense organs (eyes, nose, ears, tongue and skin)		Concept
16. Importance of personal hygiene (why and how)		Concept
17. Personal hygiene		Meaning

3.1.5. CHAPTER V : OUR NEIGHBOURHOOD

18. Effects of weather on the life	Concept
19. Idea of hot and cold weather, Rainfall its effects on clotings of people	Concept
20. Natural surroundings	Concept
21. Different weathers and their effects on living patterns	Meaning
22. Surrounding	Meaning

3.1.6. CHAPTER VI : WATER

23. Use of water in daily life	Concept
24. Sources of water	Concept

3.1.7. CHAPTER VII : OUR SKY

25. Objects seen in the sky during day and night	Concept

3.2.0. AREAS IDENTIFIED FOR ADAPTATIONS FROM III STANDARD TEXT BOOK

3.2.1. The Identified Areas And Concepts From These Text Book Are Listed Below:

Areas identified for adaptation	Page No.	Teaching Strategies
3.2.2. CHAPTER I : THINGS AROUND US		
1. Around us	1	3.1 Concept
2. Natural things, Man made things	5	3.2 Concept
3. Living things and Non living things	2 & 3	3.3 Concept
3.2.3. CHAPTER II : PLANTS AND ANIMALS AROUND US		
4. Common and Specific features of plants	8 & 9	3.4 Concept
5. Similarities and Differences	7	Meaning
6. Thick woody trunk	7	Meaning
7. Lovely green leaves	7	Meaning
8. Swaying branches of trees	7	Meaning
9. Seed and Seeling	8	Meaning
10. Apart, Erect, Alike	9	Meaning
11. Natural resources	11	3.5 Concept
12. Shapes of teeth, Good habits of animals	14 & 17	3.6 Concept
13. Peculiar	14	Meaning
14. Softly and Silently	15	Meaning
15. Chewing	17	Meaning
16. Soft padded feet	17	Meaning
17. Darts	17	Meaning
18. Crawl, Walking	18	Meaning
19. Glide	18	Concept
20. Beaks of birds-according to the food habits	17-18	3.7 Concept

3.2.4. CHAPTER III : ANIMALS AND THEIR WAY OF LIFE

21. Eating habits of animals		Concept
22. Similar and Different		Meaning
23. Camel is adopted to live in desert		Concept
24. Reproduction in animals and plants		Concept
25. Differenciate between water plants and land plants		Concept
26. Features of duck, frog and fish by which these are adapated to water life		Concept

3.2.5. CHAPTER IV : OUR BODY

21. Individual differences	25-26	3.8 Concept
22. Distinguish and Difference	25	Meaning
23. Various movements (Bend, Erect, Straight, Walking and running, Straight and rigid)	26	Meaning
24. Centre and Corner	28	Meaning
25. Loud and Mild sounds	28	Meaning
26. Direction and Source of sound	28	Meaning
27. Rough or smooth, Round or sharpedged, Hard or Soft, Heavy or Light	30	Meaning

3.2.6. CHAPTER V : OUR FOOD

28. Capacity and Energy	34	3.9 Concept
29. Food groups and Functions of food	35-40	3.10 Concept
30. Substances	36	Concept
31. Protection against diseases,		
Protective food	36	
Fight against diseases	37	Concept
32. Roughage	37	Meaning
33. Chewing; Swallowing; Eating	37	Concept
34. Cooking improves the taste and Too much cooking spoils the taste	38	Concept
35. Diarrhoea; Cholera	39	Concept

3.2.7. CHAPTER VI : CARE OF THE TEETH

36. Functions of human beings teeth	45-46	3.11 Concept
37. Brushing the teeth (proper methods)	46-47	3.12 Concept

3.2.8. CHAPTER VII : CLEANLINESS OF SURROUNDINGS

38. Habits of cleanliness in surroundings	50-53	3.13 Concept
39. Knowingly, Unknowingly	51	Meaning
40. Dirty water in puddle	52	Meaning
41. Dumped	53	Concept
42. Around and Surroundings	54	Meaning

3.2.9. CHAPTER VIII : MATERIALS AROUND US

43. Different materials	57,58	3.14 Concept
44. Air occupies space	59	3.15 Concept
45. Rock; Hill; Mountain	57	Concept

3.2.10. CHAPTER IX : SOLIDS, LIQUIDS AND GASES

46. Fair	61	3.16 Concept
47. Depicts	61	Meaning
48. Sufficiently	65	Meaning

3.2.11. CHAPTER X : WATER : A WONDERFUL LIQUID

49. Use of water in daily life	67-68	3.17 Concept
50. Solution	68-69	3.18 Concept
51. Dissolving	68	Meaning
52. Lump	69	Meaning
53. Powdered	69	Meaning
54. Hot, Hotter	69	Meaning
55. Separating the material	69	Concept

3.2.12. CHAPTER XI : WEATHER

56. Weather	72	3.19 Concept
57. Concept of evaporation and Condensation	73-75	3.20 Concept
58. Water cycle	76-78	3.21 Concept
59. Weather forecasts	79	3.22 Concept
60. Cloudy and Windy	72	Meaning
61. Disappearing	73	Meaning
62. Atmosphere	73	Concept
63. Cool and cooler	75	Meaning
64. Floating	75	Meaning
65. Too big to float in air	75	Concept
66. Cycle of events	76	Concept
67. Foggy	77	Meaning
68. Freezing	77	Meaning
69. Difference between ice and snow	77	Concept
70. Caught in the rain	78	Meaning
71. Forecast of the weather	79	Concept

3.2.13. CHAPTER XII : THE SEASONS

72. Seasons	84	3.23 Concept
73. Hottest	85	Concept
74. Shorter and Longer	86	Concept
75. Cold and Colder	84-85	Concept
76. Turtle	88	Meaning

3.2.14. CHAPTER XIII : THE SKY

77. Rising and Setting of the sun	91	3.24 Concept
78. Amavasya and Purnima	92	3.25 Concept

3.3.0. AREAS IDENTIFIED FOR ADAPTATIONS FROM IV STANDARD TEXT BOOK

3.3.1. The Identified Areas And Concepts From These Text Book Are Listed Below:

Areas identified for adaptation	Page No.	Teaching Strategies
3.3.2. CHAPTER I : FUNCTIONS OF DIFFERENT PARTS OF A PLANT		
79. Dispersal of seeds	7	4.1 Concept
3.3.3. CHAPTER II : USES OF PLANTS AND ANIMALS		
80. Classification of food items acording to their sources	12 & 13	4.2 Concept
81. Extracts of leaves and fruits for preparing medicine	14	4.3 Concept
82. Extractbranes	14	Meaning
83. Ayurvedic	14	Meaning
84. Fibres	17	Meaning
85. Ancient time	17	Meaning
86. Gum and Resins	14	Meaning
87. Farm animals	15-16	4.4 Concept
88. Extracts of animals	16	4.5 Concept
3.3.4. CHAPTER III : CARE AND PROETECTION OF PLANTS AND ANIMALS		
89. Photosynthesis	21	4.6 Concept
90. oxygen and Carbon-di-oxide	21	4.6 Concept
91. Seedings and Saplings	24	4.7 Concept
92. Destruction of forests	24	4.9 Concept
93. Vanamahotsava	24	4.8 Concept
94. Northern	22	Concept
95. Watering	22	Meaning
96. Extreme	22	Concept
97. Manuring	22	Concept
98. Wild life sanctuaries	26	Meaning
99. National Park	26	Concept
100.Pesticides and Insecticides	23	Concept

3.3.5. CHAPTER IV : OUR BODY AND ITS FUNCTION

101. Functions of sensory and motor nerves	34	4.11 Concept
102. Correct posture	32	4.12 Concept
103. Internal and External parts	30	Meaning
104. Blood vessels	32	Concept
105. Heart beat and Pulse beat	33	Concept
106. Electric wires in brain	36	Concept
107. Fresh air	34	Concept
108. Nostrils	34	Meaning
109. Saliva	35	Meaning
110. Digestive juices	35	Meaning
111. Absorbed	35	Concept

3.3.6. CHAPTER V : FOOD AND FOOD SANITATION

112. Food items rich in different nutrients	39-43	4.13 Concept
113. Balance Diet	43	4.14 Concept
114. Fermentation of food	43	4.15 Concept
115. Sprouting	43	Concept
116. Preservation of food	46	Concept
117. Bacterias Typhoid	47	Concept

3.3.7. CHAPTER VI : SAFE WATER

118. Polluted water	52	4.16 Concept
119. Stagnant water	53	4.17 Concept
120. Contaminated water	55	4.18 Concept
121. Filtration	55	Meaning
122. Safe water	55	Meaning
123. Cracked	51	Meaning
124. Boring deep tube wells	51	Concept
125. Mosquitoes breed	52	Meaning
126. Slope	52	Meaning
127. Platform	52	Meaning

3.3.8. CHAPTER VII : SANITATION AND DISEASES

128. Dispose Waste Water	62-64	4.19 Concept
129. Diarrhoea	64	Meaning
130. Dehydration	64	Meaning
131. Rehydration	64	Meaning
132. Slab	62	Meaning
133. Decaying	64	Meaning
134. Exposed food	64	Meaning

3.3.9. CHAPTER VIII : MATERIALS AND THEIR PROPERTIES

135. Properties of materials	69-70	4.20 Concept
136. Recognize materials	69	Meaning
137. Potter's clay	69	Meaning
138. Plasticine	69	Concept
139. Saucepan	71	Meaning
140. Transparent and Opaque objects	70	4.21 Concept

3.3.10. CHAPTER IX : WEATHER ITS INFLUENCE ON LIFE

141. Evaporation, Condensation, Humidity	80	4.22 Concept
142. Fog, Hail, Hailstones	84	Meaning
143. Overhead, Shadow	78-79	Meaning
144. Thermometre	80	Meaning
145. Wide-mouthed pots	81	Meaning
146. Spreading, Dew	83	Meaning

3.3.11. CHAPTER X : SOILS AND CROPS

147. Soils, Humus and Loam soil	88-90	4.23 Concept
148. Ways of increasing Crop yield	89-90	4.24 Concept
149. Decaying	89	Concept
150. Clayey, loamy	89	Concept

3.3.12. CHAPTER XI : WORK, FORCE AND ENERGY

151. Conversion	97-101	4.25 Concept
152. Slowing down motion	99	Concept
153. Speeding up motion	99	Concept
154. Inclination	99	Meaning
155. Steam engine	100	Concept
156. Piston	100	Meaning

3.3.13. CHAPTER XII : THE SKY AND THE EARTH

157. Solar system	105-107	4.26 Concept
158. Revolution	106	4.27 Concept
159. Rotation	106	4.28 Concept
160. Purnima	109	Concept
161. Amavasya	109	Concept
162. Satellite	109	Concept
163. Artificial satellites	109	Concept

3.4.0. AREAS IDENTIFIED FOR ADAPTATIONS FROM V STANDARD TEXT BOOK

3.4.1. The Identified Areas And Concepts From These Text Book Are Listed Below:

Areas identified for adaptation	Page No.	Teaching Strategies
3.4.2. CHAPTER I : GROWTH AND RESPONSE TO STIMULI IN LIVING THINGS		
164. Stimulus and Response	4	5.1 Concept
165. Sensitive, Stimuli	4	Meaning
166. Slightest and Slightly	6	Meaning
167. Move away and Move towards	4	Meaning
3.4.3. CHAPTER II : RESPIRATION AND REPRODUCTION IN LIVING THINGS		
168. Respiration	9-10	5.2 Concept
169. Reproduction	12	5.3 Concept
170. Break down of food	10	Phrase
171. Lime water	10	Meaning
172. Off springs	11	Meaning
173. Germinating	11	Meaning
174. Layering	12	Meaning
175. Budding	12	Meaning
3.4.4. CHAPTER III : HOW LIVING THINGS ADAPT THEMSELVES		
176. Habitual	17	5.4 Concept
177. Differenciate between Water plants and Land plants	19-21	5.5 Concept
178. Adapt	16	Concept
179. Unique, Distinct	16	Meaning
180. Streamlined	19	Meaning
181. Webbed feet	20	Meaning
182. Water skaters, Water boaters	20	Meaning
183. Conical	24	Meaning
184. Shed their leaves	24	Meaning
185. Evergreen	23	Concept
186. Burrowing	28	Meaning
3.4.5. CHAPTER IV : FROM SEEDS TO SEEDLINGS		
187. Germinate	30-31	5.6 Concept
188. Dry hot summer	30	Concept
189. Green fields	30	Meaning
190. Baby plants	30	Meaning
191. Moisture; immerse, soaked	31	Concept
192. The future stem	31	Meaning
193. Thick yellow fleshy parts	31	Meaning
194. Special nursery beds	32	Phrase
195. Transplanted	32	Meaning
196. Favourable conditions	33	Meaning

3.4.6. CHAPTER V : THE BONE-CASE - OUR BODY AND ITS MOVEMENTS

197. Bones-collar bones, Back bones, Spinal cord, etc.	36-43	5.7 Meaning
198. Voluntary and Involuntary actions	43	Meaning
199. Wonderful machine	36	Meaning
200. Injury and Shock	36	Meaning
201. Smooth or Knobby	37	Meaning
202. Eye sockets	39	Meaning
203. Bend like a bow	39	Concept
204. Absorbed in body	36	Concept
205. How skull protects the brain	39	Meaning
206. Flat foot	41	Concept
207. Fore arm and Upper arm	42	Meaning
208. Controlled by your will	43	Concept
209. Ruin your life	44	Concept
210. Contraction and Relaxation of muscles	42	Meaning

3.4.7. CHAPTER VI : DEFICIENCY DISEASES

211. Variety of nutrients Vegetarian and Non-vegetarian food stuffs	46-47	5.8 Concept
212. Balanced diet - Importance and Sources	47	5.9 Concept
213. Deficiency	50	Meaning
214. Roll up the sleeves	50	Concept

3.4.8. CHAPTER VII : COMMUNICABLE DISEASES

215. Communicable diseases or Infectious diseases	56-60	5.10 Concept
216. Vaccination, Immunization	60-61	5.11 Concept
217. Insectides	61	Meaning

3.4.9. CHAPTER VIII : COMMUNITY SANITATION

218. Compost pit, Manure, Biogas land fill	64-69	5.12 Concept

3.4.10. CHAPTER IX : SOIL CONSERVATION

219. Soil, Natural resource, Silting	71	Meaning
220. Erosion, Fertile, Manure	72-74	Meaning

3.4.11. CHAPTER X : AIR : ITS USES AND ITS POLLUTION

221. Pressure	78	5.13 Concept
222. Air gets polluted	80	5.14 Concept
223. Harmful gases	81	Meaning

3.4.12. CHAPTER XI : FORCE WORK AND ENERGY

224. Force, Force of gravity	84-85	5.15 Concept
225. Work, Capacity, Energy	86-89	5.16 Concept
226. Electric energy	89	Meaning
Solar energy	90	Meaning
Wind energy	89	Meaning
Turbines	89	Meaning

3.4.13. CHAPTER XII : SIMPLE MACHINES

227. Machine screw jack, Lever, Wedge	93-98	5.17 Meaning

3.4.14. CHAPTER XIII : SHADOWS AND ECLIPSE

228. Opaque objects, Transculent objects Transparent objects, Shadow, Source of light, Sundial, Eclipse, Solar eclipse, Astronomers, Panchang	100-107	5.18 Meaning

3.4.15. CHAPTER XIV : ACCIDENTS CAN BE AVOIDED

229. Carelessness; Dangerous; Accident	109-112	5.19 Concepts
230. Poisoned medicine	111	Concept
231. Traffic rules	112	Meaning
232. Antiseptic solution	115	Concept

3.4.16. CHAPTER XV : MAN, SCIENCE AND ENVIRONMENT

233. Nature	117	5.20 Concept
234. Nature resource for comfort, Precious resources	118	5.21 Concept
235. Green revolution	118	Meaning
236. White revolution	118	Meaning
237. Progress in science	118	Meaning
238. Progress in technology	-	Meaning

3.5.0. AREAS IDENTIFIED FOR ADAPTATIONS FROM VI STANDARD TEXT BOOK

3.5.1. The Identified Areas And Concepts From These Text Book Are Listed Below:

Areas identified for adaptation	Page No.	Teaching Strategies
3.5.2. CHAPTER I : SCIENCE IN EVERYDAY LIFE		
239. Scientific thinking	1	6.1 Concept
240. Communication	1	Meaning
241. Neighbouring kingdom	1	Meaning
242. Scientific method	4	6.2 Concept
243. Microscopes	5	6.3 Meaning
244. Entertainment	1	Meaning
245. Systematic approach	1	Meaning
246. Fastest	3	Concept
247. Harsh sound	3	Meaning
248. Evidence, Analyse, Assumption	4-5	Meaning
249. Scientific discoveries	6	Meaning
3.5.3. CHAPTER II : THINGS AROUND US		
250. Things Around us	9	6.4 Concept
251. Natural and Man made things	9	6.5 Concept
252. Living and Non living things	9	6.6 Concept
253. Matter; Mass; Volume, Melting point, Evaporation; Boiling point; Condensation; Freezing	14-26	6.7 Concept
254. Investigation and Application	10	Concept
255. Grouping and Sorting	10	Meaning
256. Release	14	Meaning
257. Elements	19	Meaning
258. Conductors and Bad conductors		Meaning
3.5.4. CHAPTER III : SEPARATION OF SUBSTANCES		
259. Mixture	28	6.8 Concept
260. Impurities	30	6.9 Concept
261. Magnetic separation, Decantation Sedimentation, Centrifugation, Filtration, Evaporation, Crystallization, Sublimation, Distillation	33-39	6.10 Concept
262. Hand picking, Seiving, Winnowing, Loading	32-35	Meaning

3.5.5. CHAPTER IV : MEASUREMENT

263. Measurement	43-48	6.11 Concept
264. Area; Rectangle; Triangle; Volume; etc, Mass, Kilogram	48-54	Concept
265. Misinforms	44	Meaning
266. Precautions	46	Meaning
267. Spherical surface	47	Concept
268. Wrapped and Wound	48	Meaning
269. Regular and Irregular shapes	49-50	Meaning
270. Sinks in water	53	Meaning
271. Clinical and Lab thermometer	58	Meaning
272. Athlete	61	Meaning
273. At your will	61	Concept

3.5.6. CHAPTER V : CHANGES AROUND US

275. Desirable change; Underisable change; Periodic change; Reversible change and Irreversible change	68	6.13 Concept
276. Earthquakes, Accidents	70	Meaning
277. Predict	69	Meaning
278. Blunt	71	Meaning
279. Flowering of plants	73	Concept
280. Ripening of fruits	73	Concept
281. Rusting	73	Concept

3.5.7. CHAPTER VI : MOTION, FORCE AND MACHINES

282. Motion, Random motion, Circular motion, Oscillatory motion, Periodic motions	76-78	6.14 Concept
283. Force, Muscular force, Magnetic force, Electrostatic force, Gravitational force, Frictional force	79-87	6.15 Concept
284. Simple machines	87	Meaning
285. Squeezing, Hammering, Pressing, Lifting, Opening, Shutting, Kicking, Lubrication	87-90	Meaning

3.5.8. CHAPTER VII : THE LIVING WORLD

286. Living organism	93	6.16 Concept
287. Vertebrates and Invertebrates	107	Concept
288. Star-shaped	93	Meaning
289. Hand lens, Magnifying glass	93	Meaning
290. Elongation and Eventually	97	Concept
291. Names and Surnames	100	Meaning
292. Scientific names	100	Concept

3.5.9. CHAPTER VIII : STRUCTURES AND FUNCTIONS OF THE LIVING BODY

293. Organs	111-115	6.17 Concept
294. Milk teeth, Permanent teeth, Respiratory system, Nervous system, Circulatory system, Urinary system, Reproductive system	118-125	Meaning
295. Tap root and Fibrous root	111-112	Concept
296. Nodes and Internodes	113	Meaning
297. Spine	114	Meaning
298. Tendrils	115	
299. Net work of capillaries	122	Meaning

3.5.10. CHAPTER IX : AIR

300. Components of air, Atmosphere, Gaseous substance, Compressed	129-130	6.19 Concept
301. Crumpled	132	Meaning
302. Diver, Oxygen, Respiration, Higher altitudes	133	Meaning

3.5.11. CHAPTER X : WATER

303. Sources of water	141	6.20 Meaning
304. Refining	144	Concept
305. Saline water, Hard water, Soft water	146	6.21 Meaning
306. Water pollution	148	Concept

3.5.12. CHAPTER XI : ENERGY

307. Work, Energy	151	6.22 Meaning
308. Mechanical energy; Chemical energy; Light energy, Sound energy, Heat energy, Solar energy, Electric energy	154-160	Meaning
309. Turbines, Thermal Power Station	150-160	Meaning

3.5.13. CHAPTER XII : BALANCE IN NATURE

310. Balance in nature	171	6.25 Concept
311. Animals products, Plants products, Harbivorous animals, Carnivorous animals	165-166	Meaning
312. Water pollution, Noise pollution	174	6.24 Concept
313. Dependent	163-165	

3.5.14. CHAPTER XIII : THE UNIVERSE

314. Universe	177	6.26 Concept
315. Milky way, Galaxies, Constellations, Saptareshi, Comets, Asteroids, Meteors, Planets, Satellites, Dhruvatara, Solar system	179-186	Meaning

3.6.0. AREAS IDENTIFIED FOR ADAPTATIONS FROM VII STANDARD TEXT BOOK

3.6.1. The Identified Areas And Concepts From These Text Book Are Listed Below:

Areas identified for adaptation	Page No.	Teaching Strategies
3.6.2. CHAPTER I : STATES OF MATTER		
316. Solids and Liquids have surfaces but gases do not	1	7.1 Concept
317. Heap of tar	2	Meaning
318. Continents of earth	2	Meaning
319. Fossil records	3	Meaning
320. Concentrated solution	4	Concept
321. Pole vaulter or High jumper	5	Meaning
322. Fragrance	3	Concept
3.6.3. CHAPTER - II : ELEMENTS, COMPOUNDS AND MIXTURES		
323. Elements, Compounds and Mixtures	7-8	7.2 Concept
334. Abbreviation or Symbols	11	7.3 Concept
335. Chemical Formula, Chemical Reaction, Ratio,	9	6.6 Concept
Equations, Reactants, Products	12-15	Meaning
3.6.4. CHAPTER III : ACIDS, BASES AND SALTS		
326. Combination, Classification	19	7.4 Concept
327. Salts, Oxides, Properties of acids and Bases	21	7.5 Concept
328. Moist air	19	Meaning
329. Dazzling flame	20	Meaning
330. Soapy to touch	20	Meaning
331. Blue litmus and Red litmus paper	21-23	Meaning
332. Neutralisation	26	Meaning
333. Fire extinguishers	25	Meaning
334. Electroplating	25	Meaning
335. Dyeing	25	Meaning
336. Calico printing	25	Meaning
337. Sea a great sources of salt	26	Meaning
338. Softened		
3.6.5. CHAPTER - IV : HEAT		
339. Heat energy, Mechanical energy, Expansion, Melting point	30-35	7.5 Concept
340. Emits light	30	Meaning
341. Rubbing palms vigorously	30	Meaning
342. Gentle and Sustained warmth	30	Meaning
343. Expand and Contract	32	Concept
344. Bearable	32	Meaning
345. Calorie joule	33	Meaning
346. Vegetable oil	34	Concept
247. Latent	35	Concept

3.6.6. CHAPTER V : TRANSFER OF HEAT

348. Conduction of heat	38	7.7 Concept
349. Good conductors, Bad conductors, Convection, Radition	39-41	Concept
350. Hardly be detected	38	Concept
351. Clamp	38	Meaning
352. Cooking utensils	39	Meaning
353. Inflammable substances	40	Meaning
354. Railway compartment	41	Meaning

3.6.7. CHAPTER VI : LIGHT AND SHADOWS

355. Source of light, Natural source of light, Man made light	45	7.9 Concept
356. Luminous objects, Non-luminous objects	49-50	Concept
357. Eclipse, Lunar Eclipse	46	Concept
358. Pierce	46	Meaning
359. Filament	46	Concept
360. Burning globe	46	Concept
361. Reflectors	47	Concept
362. Periscope	49	Meaning
363. Transparent, Transculent and Opaque objects	49	Concept
364. Shadows	50	Concept
365. Crescent	47	Meaning

3.6.8. CHAPTER VII : MIRRORS AND REFLECTION OF LIGHT

366. Concave mirrors, Convex mirrors	59	Concept
367. Polished shiny surface	55	Meaning
368. Bounces	56	Meaning
369. Reflection	57	Meaning
370. Point of incidence, Incident ray, Normal, Angle of incidence, Angle of reflection	57	Meaning
371. Lateral inversion, Real image, Virtual image	58	Meaning
372. Distorted	58	Meaning
373. Search lights, Rear view mirrors	61	Meaning

3.6.9. CHAPTER VIII : SOUND

374. Sound	63	7.13 Concept
375. Vibration or Oscillation	63	Concept
376. Time, Period, Frequence, Loudness and Pitch	65	Concept
377. Musical instruments	66	Concept
378. String instrument, Wind instrument, Membrane instrument, Ghana vadhya	66	Concept
379. Notes or Swara modulate	66	Concept
380. Muffled	68	Meaning
381. Delicate and Fragile organs	68	Meaning
382. Ultrasonic, Auditory nerve	68	Meaning
383. Hearing mechanism in human ear	67	Meaning

3.6.10. CHAPTER IX : ELECTRIC CHARGES AT REST

384. Electroscope, Conductors, Insulators	79-80	7.14 Concept
385. Repelled	76	Meaning
386. Positive and Negative charges	77	Concept
387. Insulators	81	Concept
388. Thunderstorm	81	Meaning
389. Lightning conductors	82	Meaning

3.6.11. CHAPTER X : ENEGRY

390. Kinetic energy, Potential energy, Transformation of energy, Lubricated	84	7.15 Concept
391. Mechanical energy	84	Meaning
392. Renewable sources	87	Concept
393. Generator	85	Meaning
394. Transformation of energy	85	Meaning
395. Ferment animal wastes	88	Meaning
396. Indiscriminately	88	Meaning

3.6.12. CHAPTER XI : WATER

397. Saline water, Distillation	91-98	7.16 Concept
398. Electrolysis	91	Meaning
399. Electrolysis of Water	91	Concept
400. Density	93	Concept
401. Hot water bags, Room coolers, Desert coolers	94	Meaning
402. Corrosion, Rusting of iron	96	Concept
403. Saturated solution, High in salinity solution, Starts wilting, Ion exchange resins, Epidemics, Drainage system, Toxic chemicals	97-100	Meaning, Phrases & Words
404. Scales in the boiler		Meaning

3.6.13. CHAPTER XII : AIR

405. Humidity air pollution	102-107	7.17 Concept
406. Inert gases	102	Meaning
407. Muggy weather	102	Meaning
408. Deflagrating spoon	105	Meaning
409. Oxygen cylinders	106	Meaning
410. Explosives	107	Meaning
411. Aerated drinks	107	Meaning
412. Auto exhaust	108	Meaning
413. Ventilation	108	Meaning
414. Scrubbing	108	Meaning

3.6.14. CHAPTER XIII : ORGANISATION OF THE BODY

415. Multicellular organisms, Organ systems, Tissues, Membrane, Cytoplasm, Nucleus	111-113	7.18 Concept
416. Various levels of organisation	111	Concept
417. Tissues	112	Concept
418. Increase in the number of cells	114	Concept
419. Flagella	116	Concept
420. Meristematic tissue	117	Concept
421. Dermal, Vascular and ground tissues, Xylem, Phloem	117	Concept
422. Epithelial tissue	119	Concept
423. Nervous tissue, Connective tissue, Bones and Cartilages	120	Concept

3.6.15. CHAPTER XIV : LIFE PROCESSES - I

424. Nutrition, Respiration, Growth and Reproduction, Indigestion, Assimilation, Stethoscope, Skeleton, Locomotion	123-128	7.19 Concept
425. Autotrophs	123	Meaning
426. Heterotrophs	126	Meaning
427. Pseudopodia	128	Meaning
428. Engulf	128	Meaning
429. Tentacles, Sting cells	128	Meaning
430. Emergency	137	Meaning
431. Finger like projections	130	Meaning

3.6.16. CHAPTER XV : LIFE PROCESSES - II

432. Reproduction	148	7.20 Concept
433. Growth and Development	149-150	7.21 Concept
434. Copies of itself	148	Meaning
435. A Sexual reproduction		
436. Sexual reproduction, Binary fission, Budding	148	Concept
437. Hard protective coat	150	Meaning
438. Regeneration	150	Meaning
439. Hermaphrodites	152	Meaning

3.6.17. CHAPTER XVI : FOOD

440. Carbohydrates, Protiens, Vitamins	160-162	7.22 Concept
441. Balance Diet	163	7.23 Concept
442. Enzymes	162	Meaning
443. Polymer	162	Meaning
444. Staple food	163	Meaning

3.6.18. CHAPTER XVII : HEALTH AND DISEASES

445. Hygienic habits	173	7.24 Concept
446. Malnutrition	174	7.25 Concept
447. Green revolution	173	Meaning
448. Deficient in carbohydrates, Vitamin deficiency	174	Meaning
449. Essential nutrients	175	Meaning
450. Prevention is better than cure	176	Meaning
451. Pasteurisation of milk	179	Meaning
452. Chlorination	180	Concept

3.6.19. CHAPTER XVIII : SOIL

453. Soil, Nourishment, Black soil, Resource	185-191	7.26 Concept
454. Red latosol, Basaltic, Desert soil	186	Concept
455. Mountain soils, Laterite type of soil, Pastures and Shrub forests	188	Concept
456. Weathering	191	Concept

These concepts and meanings were identified by consultations with the teachers teaching Science in IED and special school on the basis of the following guidelines approved by various experts involved in the education of the hearing impaired in the country.

3.7.0. Guidelines For Teaching Science To Hearing Impaired Children

Integration of the hearing impaired requires adaptation in teaching techniques aids and equipments to facilitate them to cope with regular classroom teaching. The text books designed for the hearing children (IED settings) are verbally loaded and each lesson of the text book has specific learning outcomes and instructional procedures. The learning outcomes should be kept at the same level for both the hearing impaired and the hearing children especially in the integrated setting

(the learning experiences may vary). The learning experiences which are usually provided for the hearing children may or may not be relevant to the hearing impaired children, but little adaptation in the content and methodology may facilitate them to achieve these determined learning objectives. As a result, adaptation in instructional material and methodology becomes inevitable for effective integration of the hearing impaired in regular schools.

Adaptation of instructional materials may prove effective technology for educating the hearing impaired children in regular schools. Adaptation in instructional materials includes adjustment in organising instructional materials, teaching aids and equipments, presentation style, evaluation of performances and providing enriched (additional) self learning material to the hearing and the hearing impaired children. In short, this refers to the whole package of instructional strategies which can make the hearing impaired children learn the necessary information and taught concepts. In the light of this conceptualization, the following guidelines are suggested which may be helpful to the teachers while teaching Science to the hearing impaired children in the integrated class.

3.7.1. General Guidelines

- For teaching each unit, the teacher needs to list out all

The visual and tactile materials should be given in different sizes and colours. The teaching aids should be of interest to both the hearing impaired as well as the hearing children.

- Listing of objects and pictures should follow principle of associations for better learning. In case the teachers find any difficulty in providing the same learning experiences to the hearing impaired, then that activity should be modified/substituted. Omission of teaching the concept in integrated class should be done only when the teacher feels that teaching of these concept is going to consume more time and may create feeling of boredom among the hearing children. The omitted concepts need to be taught by the teacher after the class or in the resource room.

- Teaching should be based on the earlier learning experience of the child. If the teaching is planned in relation to earlier experiences, it helps the child in better performance in the activity given. This may result in positive reinforcement which may sustain his/her interest for learning.

- The principles of known to unknown, simple to complex, etc., advocated for the hearing children need to be followed for these children also for developing learning materials.

- For making these children understand the difficult concepts, the teacher needs to provide concrete situations as a very simple learning exercise for the hearing, child, may be complicated for the hearing impaired child. This child requires specific instructions for specific task. Sometimes, the teacher has to explain things through dramatization and creating real situations.

- For effective participation the teacher should ask small questions to these children which require either one word or two word answers at least at lower grades. The questions asked should be very clear and to the point.

3.7.2. Specific Guidelines For Adaptations Of Science Curriculum

In addition to the above, the following specific guidelines are also suggested for adaptation in environmental series-II (Science) for the hearing impaired in IED setting.

- Science terminology used in the class should be explained with their meaning and clear illustrations before teaching the concept. This work should be done by the resource teacher.

- The phrases and keywords used in the text need to be explained for developing better understanding. These

hearing impaired children require more concrete situations for learning more vocabulary and phrases.

- The material should be presented in such a way that it provides compensatory inputs to both the hearing impaired and hearing children for understanding the taught concept clearly.

- The comprehension level of these children should also be taken into account while teaching science concepts to them as some children are very poor in comprehension of spoken language than written.

- Aids and equipments required for teaching a particular concept of science need to be prepared well in advance by resource teacher with the help of regular teacher (subject teacher).

- Three dimension models should be used for teaching science concepts at primary level. Teacher should also try to use real objects and models as far as possible to make them clear on the concept taught in the class.

- Short trips and educational excursions should be arranged in order to provide opportunity for self exploration of the environmental things and discovery methods are considered to be more effective than the chalk and talk method.

- While providing instructions about the topic that has to be taught to the integrated class, the teacher should be clear about the basic attributes to be covered and also about making children understand the particular concept.

- While teaching the attributes relating to the concept of sound, the sound component should be supplemented with more visual cues to provide a clear understanding.

- Teacher should also determine the limits for providing various situations and examples needed for teaching a particular concept. Beyond her limits, the teacher should involve the resource teacher for teaching the difficult concept.

- Guidelines for the parents should be given and they should include more explanation and description to be given at home for developing scientific attitudes among these children.

- Teacher should enable the hearing impaired to develop abilities to discriminate, generalize, recognise and define the science concepts taught to them.

On the basis of the above mentioned guidelines for Science, this handbook was developed and used for the hearing impaired studying in IED and Special schools as an experimental material.

3.8.0. Description Of The Science Achievement Test

3.8.1. Besides handbook on adaptation of Science Achievement tests were also developed for Classes I-VII to assess effectiveness of the experimental material. The description of these tests is as follows:

3.8.2.0. Science Achievement Test

Class I & II

3.8.2.1. Description of the Test:

The test items for class I and II consisted of four main items. Each main item consisted of 5 sub-items.

Item No.I was of multiple choice type. For each question three answers were given. The students had to read and select the correct answer for filling in the blank.

Item No.II was of 'Fill in the blank' type, in which all the five answers were given first within the brackets. The students had to fill the appropriate answer in the respective blank.

Item No.III consisted of different figures, in the which the students had to see the picture and then answer the question given below.

For example:-

The figure of birds was given and few parts of the body of birds was mentioned above. The students were asked to label its parts accordingly.

Item No.IV was 'Match the following' type questions. Five items were given in 'Part-A' column and five items were given in 'Part-B' column. The students were asked to match the items of the column 'A' with the items of the column 'B'.

An example of each item of the test was worked out for the easy understanding of the test items.

3.8.2.2. Administration of the Test

The test was administered to the children individually. When the students found it difficult to understand, the help of the class-teacher was taken. No time limit was kept for the test.

3.8.2.3. Scoring of the Test

There were four main items. Each item had five sub-items. Each main item carried 5 marks and each mark was distributed for each item. The total marks was 20 for this test. Thus each correct response carried one mark.

3.8.3.0. Scienc Achievement Test

Class III

3.8.3.1. Description of the Test:

For class-III there were XII main items.

Item No.I comprised of ten sub-items which were of multiple choice questions and answers. Below each question, three answers were given. The students had to select the correct answer to fill in the blank given in the question.

Item No.II comprised of five sub-items which were of 'Fill in the blank' type. For five items their respective answers were given within the brackets. The students were asked to fill in the blanks by selecting the respective correct answers.

In item No.III the students were asked to draw the figure of a plant and to label the given parts.

In item No.IV again the students were asked to draw the figure of a man and to label the given parts.

In item No.V a picture of a bird was given and the students were asked to label its parts and to give the function of each part.

In item No.VI few man made and natural things were given and the students were asked to group the man made things with the natural things.

In item No.VII few living and non living things were given and the students were asked to circle the living things.

In item No.VIII the question given was of the 'Match the following' type. There were two columns 'A' and 'B' and below each column and items were given. The students were asked to match the items of the column 'A' with those of column 'B'.

In item No.IX two columns 'A' and 'B' were given. The column 'A' comprised of the names of the animals and in column 'B' the students were asked to write their style of movements.

In item No.X groups of solid, liquid and gaseous substances were given and the students were asked to put the substances under respective groups.

In item No.XI five statements were given and the students were asked to say whether they were true or false.

In item No.XII the question was of 'Match the following' type. There were five items below column 'A' and six items under column 'B'. The students were asked to match the items of column 'A' with those of column 'B'.

3.8.3.2. Administration of the Test

The test was conducted individually. Teachers' help was taken to explain the items of the test to the students who did not follow the instructions given. In such a case, the teachers followed the sign language. There was no time limit for the test.

3.8.3.3. Scoring of the Test

There were tweleve main items. Item No.I comprised of ten sub-items and each carried half mark. Item No.II had five sub-items and each carried half mark. Item No.III and IV carried half mark each. Item No.V to VIII carried 1 mark each. Item No. IX had five sub-items and each carried half mark. Item No.X carried one mark. Item No.XI and XII had five sub-items and each carried half mark. The total marks was 20.

3.8.4.0. Science Achievement Test

Class-IV

3.8.4.1. Description of the Test:

For class IV there were IV main items.

In item No.I there were four sub-items. It comprised of multiple choice questions and answers. For each question, three answers were given. The students had to select the best answer to fill in the blank.

In item No.II there were five sub-items. The items given were of 'Fill in the blank' type. The students were asked to fill the blanks given with the right answers.

In item No.III there were five sub-items. Under this item, five statements were given. The students were asked to tick the right and wrong statements.

In item No.IV there were five sub-items. The items were of 'Match the following' type. Five items were given under each column and the students were asked to match the items of column 'A' with those of column 'B'.

3.8.4.2. Administration of the Test

The test was given individually. The teachers' help was taken to give the explaination through sign language, to the students who did not follow the instructions of the test given. There was no time limit for the test.

3.8.4.3. Scoring of the Test

There were four main items. The item No.I had four sub-items and carried 1¼ mark each. The remaining three items had five sub-items and each carried 1 mark. The total marks was 20.

3.8.5.0. Science Achievement Test

Class-V

3.8.5.1. Description of the test:

For class-V there were IV main items.

In item No.I there were five sub-items, comprising of multiple choice questions and answers. For each question three answers were given. The students had to select the best answer to fill in the blank.

In item No.II there were five sub-items. The items given were of 'Fill in the blanks' type. The answers were given within the brackets the students were asked to fill the blanks by choosing the correct answers.

In item No.III there were five sub-items. Five statements were given under this item. The students were asked to tick the right and wrong statements.

In item No.IV there were five sub-items. The items were of 'Match the following' type. Five items were given under column 'A' and six items were given under column 'B'. The students were asked to match the items of column 'A' with those of column 'B'.

3.8.5.2. Adminstration of the Test - Done as mentioned for Classes I to III

3.8.5.3. Scoring of the test:

There were four main items. Each item had five sub-items. Each main item carried 5 marks and each mark was distributed to each item. The total marks was 20.

3.8.6.0. Science Achievement Test

Class-VI

3.8.6.1. Description of the Test:

In item No.I there were five sub-items comprising of multiple choice questions and answers. For each question four answers were given. The students had to select the best answer to fill in the blank.

In item No.II there were five sub-items. The items given were of 'Fill in the blank' type. The students had to fill the blank with appropriate answer.

In item No.III there were five sub-items. Five statements were given under this item. The students were asked to tick the right and wrong statements.

In item No.IV there were five sub-items. The items were of 'Match the following' type. Five items were given under each column and the students were asked to match the items of column 'A' with those of column 'B'.

3.8.6.2. Administration of Test - Conducted in the same way as mentioned for Class III

3.8.6.3. Scoring of the test:

There were four main items. Each item had five sub-items each mark was distributed to each item. The total marks was 20.

3.8.7.0. Science Achievement Test

Class-VII

3.8.7.1. Description of the Test:

In item No.I there were five sub-items. It comprised of multiple choice questions and answers. For each question, four answers were given. The students had to select the best answer to fill in the blank given.

In item No.II there were five sub-items. The items given were of 'Fill in the blank' type. The students had to read the statement given and fill the blank with the right answer.

In item No.III there were five sub-items. Five statements were given under this item. The students were asked to tick the right and wrong statements.

In item No.IV there were five sub-items. The items were of 'Match the following' type. Five items were given under each column and the students were asked and match the items of column 'A' with those of column 'B'.

3.8.7.2. Administration of Test : Same procedure was followed as given for Classes I-III

3.8.7.3. Scoring of the test:

There were four main items. Each item has five sub-items. Each main item carried 5 marks and each mark was distributed to each item. The total marks was 20.

CHAPTER IV

4.0. RESULTS AND DISCUSSIONS

4.1. Context

The earlier chapters of this report deal with research reviews, tests and methods used for conducting this study. In this chapter the results obtained from the data are discussed to know the effectiveness of the experimental material used for raising the science achievement of the hearing impaired studying in IED and special settings. It was envisaged that the adaptations done in the material for teaching difficult concepts and words listed in chapter III, will help in raising the achievement of hearing children also. This chapter deals with some of these issues and attempts to provide some solution for planning and teaching of science to hearing impaired in integrated settings. First of all the results obtained on pre-test and post-test of hearing impaired studying in IED schools have been given below in tables and followed by children from special schools. The classwise table dealing with mean value on pre-test and post-test gives details about their performances.

4.2.0. Results of Pre and Post-tests of Hearing Impaired from IED:

Table 1

4.2.1. : Pre-test and post-test scores of students studying in IED schools

Sl. No.	Class II Pre-test	Post-test
1	11	15
2	13	14
3	13	16
4	11	14
5	13	15
6	10	14
7	12	14
8	11	13
9	10	14
10	10	13
11	18	19
12	17	18
13	18	19
14	19	20
15	12	14
16	13	15
17	10	12
18	12	13
19	9	10
20	10	11
21	10	12
22	9	11

The scores given in table-1 shows that the students both hearing and hearing impaired have done better on post-test in comparison to pre-test scores (cf table-1 for more details). This means the adapted instructional material prepared was found to be suitable for the class II in integrated settings. The test was for 20 marks and 8 students out of 22 on post-test and 4 students on pre-test, achieved 15 and above marks.

Table 2

4.2.2. : Pre-test and post-test scores of students studying in IED schools

Sl. No.	Class III	
	Pre-test	Post-test
1	12	16
2	13	16
3	14	18
4	13	15
5	13	16
6	14	16
7	12	16
8	16	18
9	13	17
10	14	15
11	12	14
12	9	12
13	11	15
14	15	26
15	11	15
16	17	18
17	17	17
18	15	16
19	10	12
20	12	13
21	15	17
22	13	15
23	12	14

From the tables 1 and 2 it can be stated that the performance of the III standard hearing and hearing impaired from IED setting is better on post-test than the pre-test as 5 students out of 23 scored 15 and above marks out of 20 marks in pre-test whereas 18 students out of 23 students in post-test. The performance of these students on post-test is better from the post-test of the II standard students. 8 students out of 22 from II standard and 18 out of 23 from III standard have scored 15 and above marks on post-test.

Table 3

4.2.3. : Pre-test and post-test scores of students studying in IED schools

Sl. No.	Class IV	
	Pre-test	Post-test
1	8	12
2	10	14
3	7	10
4	6	9
5	9	12
6	4	8
7	12	16
8	9	10
9	10	13
10	8	9
11	17	18
12	12	14
13	15	17
14	12	14
15	18	19
16	18	19
17	15	17
18	10	12
19	14	16
20	17	18

From the table-3 it can be inferred that performance of IV standard on post-test in comparison to pre-test is not very good as 8 students out of 20 on post-test and 6 out of 20 on pre-test have scored 15 and above marks. But the number of such students in III standard on post-test is 18 out of 23 (cf table-2). Though the majority of students from Class IV have secured marks in 18's and 19's which shows that there is difference between students' level of achievement within the group (cf table-3 for more details).

Table 4

2.2.4. : Pre-test and post-test scores of students studying in IED schools

Sl. No.	Class V	
	Pre-test	Post-test
1	12	14
2	8	12
3	13	16
4	16	20
5	12	14
6	14	17
7	12	15
8	15	17
9	17	18
10	16	17
11	19	19
12	17	18
13	11	13
14	14	16
15	14	17
16	17	18
17	16	17
18	11	13
19	13	15
20	16	17
21	11	13
22	15	17
23	14	16
24	6	10
25	15	17

The table-4 is indicative of the fact that the student of V standard have performed better on post-test than the pre-test as the number of students scoring 15 and above marks out of 20 marks are 18 out of 25 on post-test and 11 students from pre-test. If the scores of hearing impaired students from V standard are compared with the post-test of class III and IV it can be concluded that the V standard students have done better than class III and IV students.

Table 5

4.2.5. : Pre-test and post-test scores of students studying in IED schools

Sl. No.	Class VI	
	Pre-test	Post-test
1	15	19
2	13	17
3	14	18
4	13	15
5	17	18
6	18	19
7	17	18
8	18	20
9	14	16
10	15	17
11	17	18
12	16	18
13	14	16
14	9	11
15	16	18
16	14	16
17	16	17
18	19	19
19	9	12
20	11	15
21	13	17

Table-5 shows that the performance of VI standard students studying in integrated setting is significantly better on post-test than the pre-test (cf table-5). The number of the students achieving 15 and above marks is 19 on post-test and 10 on the pre-test. If these scores are compared with the class V, the performance of VI standard is better on post-test than the V standard as the number of such students falling in 15 and above score intervals is 19 out of 21 for class VI and 18 out of 25 in class V. This means the hearing impaired studying in integrated setting have done better on post-test after the use of adapted instructional

material as the number of students achieving 15 and above marks out of 20 marks on pre-test for class VI is only 10. Hence, it can be inferred that the use of such material can help them to achieve better in Science tests.

Table 6
2.2.6. : Pre-test and post-test scores of students studying in IED schools

Sl. No.	Class VII	
	Pre-test	Post-test
1	11	13
2	9	11
3	9	10
4	13	15
5	14	17
6	16	18
7	13	16
8	8	10
9	10	12
10	13	15
11	9	12
12	13	15
13	14	17

The perusal of table-6 for class VII from integrated setting indicates that the achievement of these students on post-test is certainly better than the pre-test. The number of students achieving 15 and more marks out of 20 on post-test is 7 out of 13 students and only one has achieved above 15 marks on pre-test. The comparison with other classes on post-test scores shows that the achievement scores of the students from classes VI and III were on higher side in comparison of the students from the classes VII and IV. The classwise result given above for hearing impaired from

integrated setting reveals that the facility of adaptation/modification of curriculum is needed to help them participate in academic areas better. It also shows that such adaptations in curriculum done also helps in raising the achievement of the hearing poor achievers (normal poor achievers) in the class. Table-7 gives the results of II standard hearing impaired studying in special settings.

4.3.0. Results of Pre and Post-tests of Hearing Impaired from Special schools:

Table 7

4.3.1. : Pre-test and post-test scores of hearing impaired from special schools

Sl. No.	Class II	
	Pre-test	Post-test
1	17	19
2	9	12
3	10	14
4	17	18
5	10	12
6	18	20
7	17	18
8	19	19
9	16	18
10	17	19
11	18	19
12	18	19
13	14	15
14	17	18
15	19	19
16	18	20
17	18	18
18	17	18
19	18	19
20	17	20
21	16	18
22	14	17
23	12	15
24	10	12
25	11	14
26	16	18
27	18	20

Table-7 shows that the performance of II standard hearing impaired studying in special schools on post-test does not differ much from the pre-test as the number of hearing impaired achieving 15 and above marks on post-test is 21 out of 27 for post-test and 19 out of 27 for pre-test. The performance of students from class II of special schools is quite high in comparison to the students from class II of integrated setting (cf table-1 for more details).

Table 8

4.3.2. : Pre-test and post-test scores of students studying in special schools

Sl. No.	Class III	
	Pre-test	Post-test
1	12	14
2	13	5
3	13	16
4	14	18
5	13	16
6	7	11
7	9	11
8	10	13
9	12	14
10	8	10
11	10	13
12	9	12
13	11	14
14	13	14
15	8	11
16	12	15
17	15	17
18	11	13
19	16	18
20	8	10
21	12	15
22	9	11
23	13	14
24	8	12
25	12	13
26	15	17
27	11	13
28	12	14
29	14	15

The scores on post-test given in table VII for class III of hearing impaired studying in special school show that the students achieving 15 and above marks on post-test are 10 out of 29 and 3 from pre-test. This means, the performance of III standard hearing impaired studying in special schools in comparison to the III standard students from integrated settings is much lower (cf tables 2 and 8 for more details).

Table 9

4.3.3. : Pre-test and post-test scores of students studying in special schools

Sl. No.	Class IV	
	Pre-test	Post-test
1	7	9
2	8	10
3	8	12
4	9	12
5	9	10
6	12	16
7	10	14
8	9	13
9	8	12
10	17	18
11	14	16
12	14	16
13	9	13
14	17	18
15	16	18
16	16	18
17	18	19
18	16	17
19	15	17
20	14	17
21	11	13
22	16	18
23	12	14
24	14	16
25	17	18
26	13	14
27	16	17
28	15	16
29	17	17
30	10	14
31	14	16
32	17	19
33	16	18

The perusal of the table-9 makes it clear that the performance of hearing impaired studying in special schools is better on post-test. The number of hearing impaired achieving 15 and above out 20 marks in the given test is 19 out of 33 on post-test and 14 for pre-test. The comparison of table-9 with table-3 given for integrated setting shows that the performance of IV standard hearing impaired students studying in integrated setting on post-test was better than the students studying in special schools (cf tables-9 and 3 for more reference).

Table 10

4.3.4. : Pre-test and post-test scores of students studying in special schools

Sl. No.	Class V	
	Pre-test	Post-test
1	15	17
2	13	15
3	11	13
4	15	16
5	12	14
6	14	17
7	13	15
8	15	17
9	16	18
10	17	18
11	13	15
12	18	20
13	16	18
14	17	17
15	14	15
16	18	20
17	17	18
18	15	17
19	12	14
20	9	12
21	7	10
22	9	13
23	8	10
24	9	12

Sl. No.	Class V Pre-test	Post-test
25	9	12
26	8	13
27	8	12
28	10	14
29	12	14
30	10	11
31	13	15
32	14	15
33	9	10
34	12	14
35	13	15
36	12	14
37	13	16
38	10	12
39	14	18
40	13	17

The table-10 is indicative of the fact that the hearing impaired from class V of special school have performed better on post-test than pre-test as the number of students scoring 15 and above marks on post-test is 22 out of 40 and 11 on pre-test. This result compared with class V of integrated setting shows that the V standard students from integrated setting have done better than special school (cf tables-4 and 10).

Table 11

4.3.5. : Pre-test and post-test scores of students studying in special schools

Sl. No.	Class VI Pre-test	Post-test
1	16	18
2	12	16
3	10	11
4	13	14
5	19	13

Sl. No.	Class VI Pre-test	Post-test
6	10	10
7	13	15
8	16	18
9	13	16
10	12	15
11	14	16
12	13	14
13	14	16
14	15	18
15	18	19
16	13	15
17	13	16
18	14	18
19	6	10
20	12	14
21	11	13
22	11	13
23	10	12
24	12	13
25	9	10
26	6	9
27	14	17
28	13	15
29	15	18
30	12	16
31	10	12
32	16	18
33	8	12
34	13	14

From the table-11 it is clear that the performance of VI standard students on post-test is better than the pre-test. The number of students achieving 15 and above marks on post-test is 18 out of 34 on post-test and 4 out of 34 on pre-test. The results compared with the results of VI standard of integrated setting show that the hearing impaired studying in integrated setting have done better than the students studying in special schools. This means the hearing impaired studying

in integrated setting achieved more than the hearing impaired studying in integrated setting.

Table 12

4.3.6. : Pre-test and post-test scores of students studying in special schools

Sl. No.	Class VI Pre-test	Post-test
1	17	19
2	16	18
3	15	18
4	14	17
5	17	18
6	17	18
7	16	18
8	18	19
9	12	14
10	15	17
11	13	15
12	9	12
13	10	13
14	11	14
15	14	16
16	9	12
17	8	10
18	10	13
19	12	15
20	11	14
21	9	11
22	10	13
23	8	10
24	7	10
25	8	8
26	9	11
27	10	12
28	9	12
29	8	9
30	10	12
31	9	12
32	12	14

The table-12 shows that the performance of VII standard is also higher on post-test than the performance on pre-test.

The number of hearing impaired achieving 15 and above marks on post-test is 12 out of 32 and 8 on pre-test. The comparisons between the results of the VII standard studying in IED shows that the performance of VII standard studying in IED is better than the students studying in special if students studying in special schools have done better than the students studying in IED setting on pre-test, as the number of such students scoring above 15 from special schools on pre-test is 8 out of 32 and 1 out of 13 from IED settings (cf table-12 and 6).

The result received on mean value on pre and post-test scores according to the educational and classwise setting is given in table mentioned below.

4.4.0. Mean Values of the Scores Obtained on Pre and Post-test of Hearing Impaired Studying in IED and Special Schools:

Table 13

4.4.1. : Mean values of the scores obtained on pre and post-test of hearing impaired in IED and special schools

Class	IED		Special schools	
	Pre-test	Post-test	Pre-test	Post-test
II	12.1	13.8	15.4	16.6
III	12.8	15.2	10.95	13.7
IV	5.9	13.8	12.6	14.6
V	13.7	15.8	12.56	14.75
VI	14.6	16.98	11.4	14.5
VII	11.6	13.90	11.3	13.81

4.4.2. (A) Comments:- From the above mentioned table, it can be stated that the performance of the hearing impaired from IED and special schools on post-test is better than the

pretest. But the performance of class II from special schools is better than the II standard students studying in IED settings both at pre-test and post-test as the mean values for class II on pre-test and post-test from special school are 15.4 and 16.6 and 12.1 and 13.8 from IED settings. It may be due to the following reasons:

(i) The hearing impaired children studying in special schools are generally prepared in reading, writing and understanding skills for about 3-4 years whereas children attending IED settings are generally enrolled without providing preparatory education.

(ii) Variation in educational, socio-economic status of the parents and their involvement in the education of their hearing impaired children.

(iii) The teachers teaching the deaf in special schools are better communicators for severely and profoundly hearing impaired than the regular teachers as in India we have not equipped the regular teachers with total communication skills. Therefore, the teachers working in special schools though less qualified could teach science concepts more adequately with the help of this experimental materials and also due to orientation given about how to use it more effectively.

(iv) The variation in personal factors such as intelligence, study habits, motivation levels and other academic and non academic factors might have caused this variation.

(B) The hearing impaired studying in IV standard in special schools have also performed better both on pretest and post-test in comparison to the hearing impaired from IED settings as the mean values for hearing impaired from Special schools on pre and post test are 12.6, 14.6, 5.9 and 13.8 for hearing impaired from IED (cf Table-13 for more details). The difference in mean values on the basis of type of educational settings seems to be due to these factors:

(i) Those hearing impaired who were enrolled directly without preparation could not cope with the regular instructions and might have been retained or shifted to special schools. Those hearing impaired who got admission in IED after receiving some preparatory education may do better in II and III standards as the hearing impaired generally have been reported doing better on academic areas upto II, III & IV Standards because they are ahead of hearing children in reading, writing skills due to 3 to 4 years intensive preschooling. But, it is difficult for them to sustain with the increasing academic requirements in regular schools due to the increasing difficulties in content areas.

(ii) The hearing impaired are generally taught with giving very concrete situations and their processes for abstract thinking might have not been encouraged by the system so they could not do well on the science achievement tests in IED settings.

(iii) The hearing impaired and particularly of prelingual hearing impaired are very poor in linguistic skills due to two reasons:

(a) Lack of proper linguistic inputs from the beginning of their childhood.

(b) Lack of systematic approach for the development of linguistic skills by the preschool teachers and parents or preparatory educationists. The problem of expression through writing and reading increases if they are not helped to develop these skills properly, this may cause difficulty in performing adequately in academic tasks. This may happen more with hearing impaired who are educated through IED systems who have not given adequate preparatory education than with the hearing impaired studying in Special schools.

(C) The performance of hearing impaired of classes V and VII from integrated settings in general have performed better

both on pre and post-tests than the special School students (cf Ttble-13 for more details). This might have happened due to thc following reasons:

(a) Teachers teaching in special schools generally are not well qualified in Science Content areas in Comparison to the teachers working in IED settings.

(b) The hearing impaired studying in IED get used to the methodology used for teaching by VI Class and also are able to do lipreading of their science teachers properly. Besides the teachers might by now have understood their limitations in understanding and therefore may be trying to meet their educational needs by adopting suitable methods for teaching.

(c) Difference in teaching styles and availability of more reading material, library books and lab facilities in IED settings. These facilities are barely available in special schools.

(D) The mean value given for hearing impaired from class VII on Science achievement pretest and post-test sessions for IED and special schools shows that the VII standard hearing impaired do not differ in their achievements both on pre and post test as the mean values for VII class from IED are 11.6

and 13.90 and for special schools 11.3 and 13.81. This means, the hearing impaired from IED setting have done slightly better than the special School students but the difference is just marginal and not very significant. This may be due to the inability for grasping difficult concepts and also inability in relating knowledge gained in earlier classes, with the result these children take more time than the normal children and regular teacher cannot afford to repeat things due to the time restrains. And hence they may lag behind. In special schools settings this situation does not arise as the teacher is aware of the problems and they generally repeat things earlier taught to help them relate the information gained earlier.

4.5.0. So far we have discussed these results on the basis of mean values and now we will discuss the results obtained through the use of analysis of covariance and t-test. These techniques were used to find out differences among the hearing impaired studying in classes II-VII from integrated and special educational settings and also groups formed on the basis of sex, age, mediumwise and type of schooling attained. The results obtained on pre-test and post-test on Science achievement, classwise obtained through the use of analysis of covariance are given in table-14.

Table 14

4.5.1. : F-value for pre-test and post-test scores received on science achievement tests of students studying in IED and special schools (classwise)

Classes	Posttest	Significance level	Pretest	Significance level
II	5.77	0.01	5.34	0.01
III	5.45	0.01	5.85	0.01
IV	23.01	0.01	15.82	0.01
V	11.15	0.01	7.54	0.01
VI	4.72	0.01	3.29	0.01
VII	20.57	0.01	18.04	0.01

The table-14 indicates that the performance of hearing impaired in general on post-test is better and significant at 0.01 level than pre-test from both integrated settings and special schools. The significance level for class IV on post-test though is significant at 0.01 level alike for other classes yet it shows greater degree of difference between the performance of hearing impaired studying from special and integrated settings and also between the performance of these children on pre-test and post-test as the 'F' value for pre-test for class IV is 15.82 and on post-test its 23.01 (cf table-14 for more details).

This may also be confirmed from table-13 as the mean values for class II for IED group of post-test is 13.8 and for special groups 16.6. And for class IV is 13.8 for IED and 14.6 for special school group which means the hearing impaired studying in special schools in classes II and IV have done better on post-test than pre-test and also performed better

than their counterparts, studying in integrated schools. The reasons for this difference may be seen from the following points:

(i) The difference in teaching styles as the teachers from special schools use total communication which also includes signing. They teach each concept by providing concrete situations whereas teachers from regular schools are not yet equipped with total communication skills and also preassume that the child studying in II standard know basic vocabulary and language. Therefore, they do not understand the difficulty of this child. Besides, they can not afford to provide concrete situations for simple basic language concepts while teaching science.

(ii) The reading, writing and comprehensive skills of the hearing impaired studying in special schools are better as they are given 3-4 years intensive training in language and speech development which facilitates than in doing better in initial classes in comparison to their counter parts who have been integrated directly in regular schools.

(iii) May be due to individual differences in term of intelligence, motivation, need for achievement and self concept. The hearing impaired children also differ from each

other not only in these personal factors but also in term of degree of hearing loss, type of hearing aid used, duration of the use of hearing aids, type of linguistic inputs received at preschool stage etc. These may be possible reason for their better performance.

(iv) The simplification of the content areas might have helped the teachers teaching science in special schools. This may also be possible reason for their better performance on post-test.

From the table-14, it is clear that the hearing impaired studying in integrated setting in general have performed better than the hearing impaired studying in special schools and especially on post-test. Thus, it can be inferred that adaptations done in science curriculum could help the hearing and hearing impaired in integrated settings as well as to the hearing impaired studying in special schools.

In this study, the analysis of covariance was not only done to know the difference between the hearing and hearing impaired classwise but also used to know the impact of various other dominating factors like type of school (Integrated Vs. segregation; sexwise; agewise and mediumwise). This study has included hearing impaired from special schools and integrated schools, so it was essential to know the impact of these

variables. The age factor was considered because most of the hearing impaired are enrolled in school at later stages and therefore the age can be a dominating factor influencing their achievements. Various studies also reported that the boys do better on abstract area of learning than the girls'. Which means the performance of the male hearing impaired should be better than the female hearing impaired on abstract areas (Thorndike, 1963; Srivastasava, 1967; Sharma, 1988). Therefore, it was decided to include this variable to know its influence on the performance of the hearing impaired sexwise. The variable medium of instruction was also considered for analysis to know whether the medium of instruction also associated with the achievement of the science of hearing impaired studying in integrated and special schools as most of the educationalists of the view that the children studying through mother tongue or regional language achieve better academic grades in comparison to those who study through English medium schools. Some of these studies also report that the students studying through English medium are better on academic achievement than those who are studying through mother tongue and regional language. This variable was included to see whether medium of instruction has any impact on the science achievement of the hearing impaired studying through these media. The studies in this area also report that the students studying in the integrated setting do better on academic area than the students studying in segregated

setting (Sharma, 1989). The t-test was used to find out the difference between the performance of hearing impaired studying in integrated and special schools from Delhi, Haryana and Karnataka. This helped in knowing the level of difference between these students according to the educational setting and mediumwise. The results obtained through analysis of covariance and 't'-test are discussed below:

Table 15
Results obtained on analysis of covariance on age variables for hearing impaired studying in integrated and special schools (classwise)

Class	'F' value	Significance level
II	34.90	0.01
III	28.48	0.01
IV	31.02	0.01
V	47.52	0.01
VI	18.51	0.01
VII	6.62	0.01

The persual of the above mentioned table indicates that the difference on age variables is significant at 0.01 for all classes, which means there is age difference among these students. From the 'F' value given above it can be stated that the significant level is higher for V standard that is 47.52 and for classes II and IV i.e., 34.90 and 31.02 respectively.

The hearing impaired identified late and given 3-4 years. Preschool education cause this difference for the hearing

impaired attending special schools. Sometimes older hearing impaired are also enrolled directly to the regular school under the provision of integrated education and they may cope with the general system with the support of educated parents. The higher 'F' value for grade-V, shows that there is a big age difference for this grade in comparison to other classes. This may also be due to the transfer of hearing impaired from special schools to regular schools after 3-4 years preparation and education at primary level on trial basis. Similarly, the 'F' value on age variables for class II and IV is higher which means there is lot of difference between the age of the hearing impaired studying in integrated and special schools. As mentioned earlier it may be due to late identifications stagnation and preschool education of hearing impaired as in India hearing impaired mostly get identified late and given preparatory education about 3-4 years for language and speech developments for their education. In this process they become older than their normal counterparts. Thus, it can be inferred that age is a very significant factor influencing science achievement of hearing impaired as the mean values for primary classes are higher for children from special schools than the integrated schools (cf table-13 for more details). Now we will discuss about the results obtained by using 't' test for sex variable for the hearing impaired studying in integrated and special school settings.

Table 16
't' value and significance level obtained on sex variable classwise, studying in integrated and special schools

Class	"t" vlaue		Significance level	
	IED	Special school	IED	Special school
II	1.13	0.98	*NS	NS
III	1.33	0.77	NS	NS
IV	0.36	0.84	NS	NS
V	0.45	0.42	NS	NS
VI	1.71	1.13	NS	NS
VII	0.30	0.09	NS	NS

* NS Not Significant

The persual of the table-16 shows that there is no difference between the performance of male and female hearing impaired from class II-VII in both the educational settings. Though the findings received on the sex difference on language competence was found to be very significant by the author in 1969, but this value was not found significant. This may be due to the fact that the hearing impaired learn through concretisation and simplication of difficult concepts. It may be due to the used simplified methodology for teaching science, might have helped both male and female to learn in the same way. As discussed earlier the complex concept need to be simplified and substituted by easier exercises to help the hearing impaired to learn difficult concepts without any difficulty. Therefore, it can be concluded that there is no difference between the performance of males and females hearing impaired science achievement from both integrated and special schools.

Table 17
't' value on variable medium of instructions used in integrated and special school for hearing impaired studying in classes II-IV

Class	Integrated settings t-value	Significance level	Special setting t-value	Significance level
II	0.23	NS	0.56	NS
III	2.08	0.05	0.36	NS
IV	0.192	NS	1.645	0.05

The above mentioned table shows that the science teaching done through English medium, Hindi medium and Kannada medium is not significant at class II level. This may be because the content covered for class II through exploring the environment is quite simple and does not involve much difficult science concepts. Therefore it is easy to understand by these students. Besides the mode of examination for class II is mostly oral and involves simply ticking the right answer from the given choices. This requires simple understanding of language. The t-value is significant for class III at 0.05 level for integrated setting which means the students studying through English medium in integrated setting performed better than those who were studying in Hindi medium. Though the difference between the two groups is not very significant, it can be stated that the children studying through English medium might be getting the support of the educated parents as reported by various studies. The children of educated parents also reported to be going to English medium schools. It may also be due to the difference in the langauge abilities acquired by these students.

The difference due to the medium for class IV also is significant at 0.05 level for the special schools where Hindi and Kannada media were used. This shows that due to the difference in teaching styles and also due to the educational facilities available for teaching science. Mostly integrated schools with English medium found to have better educational facilities for teaching science and also there were well qualified teachers for teaching science. The integrated schools are mostly Government schools and teachers are appointed here with appropriate professional qualification. This may be the possible cause for this difference (cf table 4.6 for more details). The difference seen due to the medium of instruction for Kannada and Hindi for class IV of special schools of hearing impaired from Delhi, Haryana and Mysore is at 0.05 level which indicates again the difference existed due to the lack of facilities for teaching science and less qualified teachers teaching science. As the investigator observed that the students from special schools do not have access to the laboratory and library facilities. However this difference may be attributed to the environmental factors such as lack of laboratory and library facilities.

Table 18
'F' value and its significance level on variable medium of instruction for hearing impaired studying in integrated and special schools from classes V to VII

Class	F level	Significance level
V	0.86	NS
VI	1.15	NS
VII	4.43	NS

From the table-18 it can be stated that the medium of instruction has no impact on the science achievement of the hearing impaired studying in integrated and special schools since all the values are not significant (cf table-18 for more details). The results received on analysis of covariance and t-test for class II-V show that medium of instruction is not found to be influencing their score on science achievement tests. It may be due to the following reasons:

(i) The hearing impaired have been exempted from learning three languages. Their medium of instruction and language subject remain the same. Therefore they are better on the usage of language.

(ii) Language and speech development start in selected language. Therefore they learn reading and writing skills also start from preschool stage. By the time they come to I standard their usage of the language more or less becomes equivalent to their normal counter parts.

In the end it can be inferred that medium of instruction has no significant influence on their science achievement.

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